Technical Memorandum

To: EPA Region 4 and Georgia EPD
From: Kirk Kessler, on behalf of the LCP Site Steering Committee
Subject: Response to Comments on *Site Characterization Summary Report Operable Unit 2 (OU2) Groundwater and Cell Building Area for the LCP Chemicals Site, Brunswick, Georgia, Dated February 2020*
Date: May 26, 2020

I. GENERAL COMMENTS

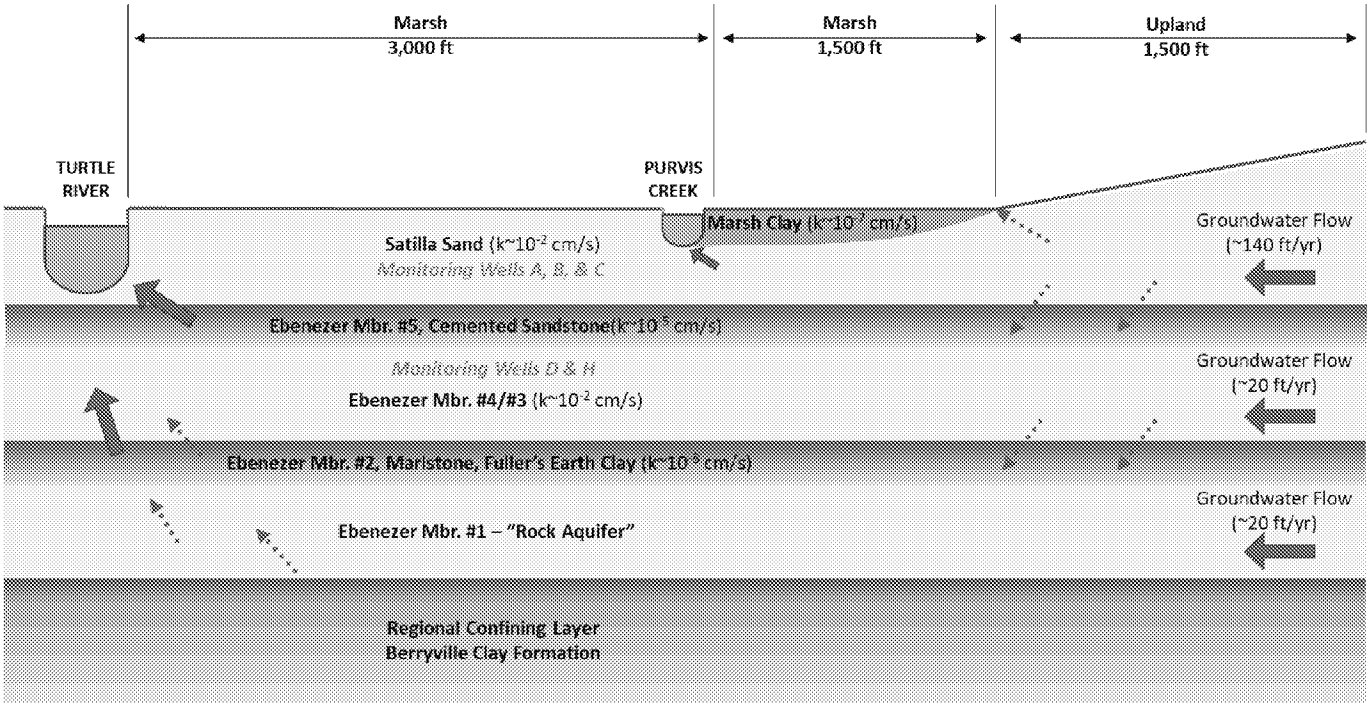
1. *The Site's groundwater and soils have been adequately characterized over the previous 25 years, and areas of historical disposal were identified. Currently, there are wells at the Site still having elevated detections for contaminants of concern (COCs) where additional sampling is needed. Please refer to the table(s) below. In addition, there may be a need in the future for additional monitoring well installations adjacent to these areas during the remedial design and action phase to assist in remediation assessment.*

Response

The table associated with the comment letter is a well-by-well review, which does not take a holistic view of the site data. For example, commenting that a particular well exhibits an "elevated" COC condition is not in of itself a basis for concluding *additional sampling is needed*. Furthermore, in the commentary regarding data trends, it appears the EPA is concluding a trend on the basis of only the most recent sampling events and does not consider the full timeline of monitoring for the trend review. We have an extensive amount of data for this site, beginning with site characterization and monitoring in 1995 carrying through to the present. Multiple site-wide sampling events have occurred as well as objective-focused monitoring events over the 25-year period. Comprehensive RI Reports were issued in 1997 and in 2002 and data reports were provided for subsequent monitoring events. The facility ceased operations in 1994 and various elements of site remediation have occurred since, such as the uplands removal response action of 1994-1997 and the caustic brine pool (CBP) removal response action of 2011-2019. Honeywell respectfully submits that no additional monitoring wells are needed to support the Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit 2.

Please note that the timeline data viewer provided with the SCR auto-scaled to the concentration range of a particular COC for the selected well which exaggerates the temporal changes in the COC concentration, which may have led to some of the comments that follow. An updated timeline viewer is provided which offers additional worksheets that fix the concentration range to a set maximum value to allow review of the data on a normalized basis.

It is important to consider the hydrogeologic conceptual model in the context of COC delineation, in that it provides for upward hydraulic gradients in the Satilla and Ebenezer aquifers with discharge boundaries to Purvis Creek and/or Turtle River (see image below, from the 1997 Groundwater RI Report, Figure 4.5-1 updated for current geologic nomenclature). These discharge boundaries can be considered as the maximum potential extent of the COC condition, and it has been shown through the extensive work under OU1 that the groundwater-to-surface water pathway does not impact the marsh receptors.



An additional mode of illustrating the COC concentrations across the site has been prepared to aid the reviewer in the understanding of the COC condition, comprised of multiple cross-sections along general groundwater flow pathlines (see attachment to this comments response). The various COCs mentioned in the comments are included on these illustrations.

2. *Overall, it is also noted that the presentation of the groundwater sampling results in the OU2 Summary Report makes it difficult to determine all the data gaps. For example, areas where it appears in the figures that additional delineation may be required have data not included on the figures, only in the pivot tables (i.e., 2018 exceedance, no 2018 upgradient sample result, pivot table does list 2019 upgradient sample result). Not including the sample location IDs on the figures with the sample results adds to the difficulty in evaluating for data gaps. EPA requests the presentation in the upcoming RI be clearer and that figures in the RI must include sample location IDs that are tied to data tables.*

Response

Additional data illustration formats in the form of cross-sections with COC concentration are provided for EPA's review. A revised Figure 4.1 is provided which shows sample location IDs.

3. *The OU2 Summary Report includes an overview of the current nature and extent of the groundwater condition including the progression of groundwater conditions for key groundwater constituents; however, it is unclear what defines the "progression" of such constituents. Section 5.1.1, Contaminant Selection for Groundwater Evaluation, states that key constituents are contaminants that exceed EPA Maximum Contaminant Levels (MCLs) or in the absence of MCLs, the tap water Regional Screening Level (RSL). However, a key component of OU2 is pH and other geochemical parameters (e.g., oxidation reduction potential, conductivity). Furthermore, there is no MCL or RSL for pH. Revise the OU2 Summary Report to clearly indicate what defines "progress" for each key constituent being evaluated, including pH and other geochemical parameters.*

Response

The context of the term "progression" used in the SCR was temporal (not improvement of a given condition).

Geochemical indicator parameters such as pH and oxidation-reduction potential were not illustrated as COC maps as they do not constitute CERCLA hazardous substances. However, detailed discussion of these data in the context of the conceptual site model will be an element of the OU2 RI Report.

4. *A review was conducted of the groundwater trend analysis data tables presented within the Report for monitoring wells constructed within OU2, specifically for mercury detections. Some of the monitoring wells still have elevated detection above the maximum contaminant level (MCL) of 2 microgram per liter (ug/L) for mercury or have detections just below 2 ug/L that are increasing over time. Further analysis of these wells with increasing trends for mercury and their sampling history is needed as some of these wells have not been sampled recently. Therefore, the current mercury concentration and/or trend is unknown within these wells. Elevated and/or increasing trends for mercury potentially coincide with the interpolated elevated alkalinity detections presented in Figure 3-4 of the recent CO_2 Sparging Phase 4 Full Scale Implementation and Monitoring Report. It is requested that the data gaps be eliminated by providing additional lines of evidence in the form of supplementary groundwater sampling data. The additional data will help evaluate the elevated detections and/or increasing trends for mercury within the wells to clarify the current state of the mercury and a path forward at the Site.*

Response

See response to General Comment 1 regarding *elevated* concentrations and apparent trends.

To clarify, Figure 3-4 of the *CO_2 Sparging Phase 4 Full Scale Implementation and Monitoring Report* provided an interpolation of the carbonate alkalinity condition **prior to** the CO_2 sparging. Carbonate alkalinity established the necessary CO_2 loading for the treatment to be effective. Carbonate alkalinity was a result of caustic releases, in the same sense as elevated pH and lowered oxidation-reduction potential which facilitated enhanced metals mobilization (i.e., the increased mercury concentration in groundwater within the CBP). The high alkalinity did not cause the elevated mercury, rather both conditions were elevated (caused) by the caustic release.

5. *The figures presented to support the discussions included in Sections 5 and 6 do not include monitoring well identifications (IDs) or indicate when the sample was collected. Section 5.1.1, Contaminant Selection for Groundwater Evaluation, states that the figures depict the most current test result for a given well. However, throughout Section 5, Current Nature and Extent of the Site Groundwater Condition, the OU2 Summary Report discusses the groundwater constituents that were exceeded in greater than 10 percent of groundwater samples collected between 2017 and 2019. Revise the figures (other than the spatiotemporal figures) intended to support Sections 5 and 6 to include monitoring well IDs and sample dates.*

Response

This is essentially the same as General Comment 2 (but adding a request to post sample dates). Section 5 figures depict the most recent of results spanning the last 3 years of monitoring. Posting sampling dates

along with well IDs on these figures in addition to the posting of the specific test makes for illegible figures with numerous overlapping labels, while adding little to the basic concept of the figures themselves (the concentration of a specific COC). The reviewer has the ability through the provided Excel pivot table to examine the full history of sampling for each well and each constituent.

6. *Spatiotemporal modeling was performed on selected groundwater contaminants and parameters at the Site. The modeling emphasis is placed on the overall contaminant trend using a non-parametric regression technique known as the Penalized Splines. This approach helps reduce the influence of outlier data points for a monitoring location by looking at both nearby data results and the condition of the location in the past and present; the contaminant trend is "smoothed" accordingly through the statistical function. Based on historical groundwater sampling and spatiotemporal modeling conducted at the Site, specifically within the Satilla Formation, the following contaminants: beryllium, chromium, selenium and vanadium were not fully contoured between the MCL/RSL value and elevated detections (source areas) for the particular contaminant within the 2018 models (most recent) presented within the Report. It is requested that the contaminants mentioned above be reviewed to determine if additional data points (i.e. monitoring wells) are needed at the Site to fully delineate the specific groundwater plume of interest. There may be monitoring wells constructed within the areas of interest, but not at the proper depth for monitoring the groundwater plume conditions. If this is the case, an additional monitoring well may need to be constructed in the Satilla Formation to adequately define and/or monitor the groundwater plume during the future phases of the project.*

Response

The geographic extent of the spatiotemporal modeling varies across the time series as determined by the lateral extent of the monitoring well network sampled for a given event/year. All sampling events were performed according to agency-approved work plans and as such, 2017 is the most recent full site-wide event available for reporting. Note that although the 2018 interpolation region is limited to the well network extent sampled on that date, the interpolation images generally match to the same geographic portions of the site depicted in the 2017 broader-based interpolation.

7. *As described above, a similar scenario exists within the Ebenezer Formation (which is located below the Satilla Formation) with the following contaminants of concern: chromium, mercury and vanadium. It is requested that the contaminants be reviewed to determine if additional data points (i.e. monitoring wells) are needed at the Site to fully delineate the specific groundwater plume of interest. There may also be monitoring wells constructed within the areas of interest, but not at the proper depth for monitoring the groundwater plume conditions. If this is the case, an additional monitoring well may need to be constructed to adequately define and/monitor the groundwater plume in the Ebenezer Formation during the future phases of the project.*

Response

See response to General Comment 1 where we believe the COC extent in the Satilla aquifer has been delineated to the extent practicable, and given the hydrogeologic setting and lack of downgradient receptors, it is reasonable to conclude the delineation is sufficiently complete. See also the cross-section illustrations of COC distribution provided in the attachment.

8. *It is noted that pH concentrations within the Satilla and Ebenezer Formations have fluctuated above and below the established removal goal of pH 10. The contour intervals have not been fully contoured within the spatiotemporal models for the low and high pH concentrations at the Site. It is requested that the pH concentrations for the Site be reviewed to determine if additional data points (i.e. monitoring wells) are needed to fully delineate the pH concentrations within the groundwater system. There may be monitoring wells constructed within the areas of interest, but not at the proper depth for monitoring the groundwater conditions.*

Response

To clarify, the CBP Administrative Order (Section VIII.14.) states the removal objective as "reducing the pH of the CBP to 10-10.5". Thus, the goal is <10.5 pH not 10.0.

This comment is no different than other prior comments made for various metal COCs, and the response provided to those prior comments equally applies to this comment regarding pH.

9. *Areas formerly containing elevated concentrations of polychlorinated biphenyls (PCBs) include: the Former Facility Disposal Area and adjacent marsh and tidal channels, Outfall Pond and Canal, Anode Loading Area, North and South Dredge Spoils Areas, Scrap Yard, Northwest Field, Material Staging Area and South Rail Yard. Removal activities in these areas were accomplished with excavation and off-Site disposal of soils. Refer to Table 4.1e 1994-1997 CBA Soil Data: Aroclors, soil boring locations with elevated detections for PCBs (i.e. LC-249, 96262-19 and 96289-02). In the locations mentioned above, were these areas remediated for elevated detections of PCBs, and were confirmation soil samples collected from these areas? If these areas have been remediated for PCBs, and confirmation soil samples were collected, it is requested that a summary of the data and results be included within the OU2 Summary Report.*

Response

Soil-based remedial action across the former cell buildings area has thus far involved placement of a soil cover to mitigate direct exposure (of the cell slabs and perimeter area surface soils) and mercury vapor emission. Data pertaining to soils in this area were provided in the SCR.

10. *Regarding chromium data for the Site, it cannot be determined from the Report if speciation was conducted to determine if hexavalent chromium is present. It is requested that sampling program be implemented at the Site for a select number of wells to determine if hexavalent chromium is present. The determination is of utmost importance to develop an adequate Baseline Risk Assessment for the Remedial Investigation Report.*

Response

This topic came up in the planning discussion for the 2012 site-wide sampling event, and chromium speciation (i.e., testing for hexavalent form) was performed in select wells (18 wells) with results summarized in a Data Report issued later that year. That report will be provided.

II. SPECIFIC COMMENTS

1. ***Section 3, Hydrogeologic Conceptual Site Model, Pages 9-12:*** *The OU2 Summary Report does not provide vertical gradient information. Although vertical hydraulic conductivity information is presented in Section 4, RI Site Characterization Work Phases, vertical movement of groundwater using the most current data from monitoring wells screened across the Satilla Formation (the A, B, and C zones) and below the cemented sandstone (the D zone) is not presented. Revise the OU2 Summary Report to present vertical gradient information as part of the hydrogeologic conceptual site model.*

Response

See the generalized hydrogeologic cross section in response to General Comment 1 regarding the overall vertical hydraulic gradients for the site. All data pertaining to vertical hydraulic head information will be presented in the OU2 RI Report along with an updated conceptual model – this level of detail is beyond what is typical for a SCR.

2. ***Section 4.3.3, 2018 CBA Soil Coring, Page 24:*** *The OU2 Summary Report references Appendix A, which includes boring logs from the CBA study; however, boring logs from other investigations are not provided. For completeness, include boring logs from all OU2 investigations or provide justification for the omission of all other boring logs.*

Response

We will provide a full set of boring logs.

3. ***Section 5.1, Overview, Page 27:*** *The nature and extent discussions include the use of the Site quadrants identified on Figure 5.1, Upland Quadrants; however, these quadrants are not depicted on any other figure for reference. Revise the figures referenced throughout Section 5 to include the quadrant boundaries.*

Response

The concept of "quadrants" stems from a frame of geographic reference used in the OU3 RI/FS, which is now commonly used to describe portions of the site. This terminology is used in the SCR and illustrated in Figure 5.1 also as a general frame of geographic reference, but it is not a sufficiently important concept to warrant placement on all base maps. Furthermore, it serves to clutter already busy figures and we do not agree that it should be included on all figures.

4. ***Section 5.1.2, Modeling, Page 28:*** *The spatiotemporal modeling was performed using GWSDAT software; however, the Interstate Technology Regulatory Council (ITRC) has identified limitations and data requirements associated with the use of GWSDAT (link). These include:*
   - *Spatiotemporal solute concentration predictions do not necessarily lie on observed data points because the program smooths rather than interpolates.*
   - *The quality of the spatiotemporal smoothing is directly influenced by the quality of the underlying data.*
   - *The analysis may be skewed if data are input from monitoring wells with disparate construction or screened in different aquifers.*

Revise the OU2 Summary Report to discuss whether any of the above limitations or data requirements were observed during modeling and how they were addressed.

Response

All models have expressed limitations, but that does not render them useless. The GWSDAT model we used is provided in the ITRC guidance document, *Groundwater Statistics for Monitoring and Compliance* as one of several statistical software packages specifically developed to visualize trends in groundwater monitoring data. The software is published in the Journal of *Environmental Modeling & Software, A Software Tool for the Spatiotemporal Analysis and Reporting of Groundwater Monitoring Data*. May 2014.

The comment fails to point out the pros to the use of this modeling application (from ITRC guidance) which include:

- Early identification of increasing trends or off-site migration.
- Evaluation of groundwater monitoring trends over time and space (holistic plume evaluation).
- Nonparametric statistical and uncertainty analyses to assess highly variable groundwater monitoring data.
- Reduction in the number of sites in long-term monitoring or active remediation through simple, visual demonstrations of groundwater data and trends.
- More efficient evaluation and reporting of groundwater monitoring trends via simple, standardized plots and tables.

All data are deemed of equal "quality". Our analysis is based on a review of well construction to match aquifer type/depth.

5. ***Figure 3.1, Potentiometric Surface and Groundwater Flow: Satilla Formation and Figure 3.2, Potentiometric Surface and Groundwater Flow: Ebenezer Formation:*** *The figures do not include the monitoring well IDs. In addition, Figure 3.1 indicates that green-colored monitoring wells were not used for the potentiometric surface interpretation, but rationale for this decision is not provided on the figure or discussed in Section 3.4, Potentiometric Surface and Groundwater Flow. Revise Figures 3.1 and 3.2 to include the monitoring well IDs and provide rationale for the omission of select groundwater elevation data for potentiometric surface interpretation.*

Response

The site monitoring well network has expanded over time to accomplish various goals. The green wells omitted from the potentiometric surface interpretation are primarily "500-series" monitoring wells installed in 2007 and 2008 to inform the design and monitor performance of the groundwater recovery system intended to treat the CBP. The wells were surveyed separately from the majority of the well network and, based on the groundwater level data, for this reason, the "500-series" monitoring wells were omitted from the potentiometric surface interpretation series. These wells are geographically clustered with other longer-term monitoring wells dispersed throughout, thus it is not necessary to use the 500 series wells in the hydrologic interpretation.

6. **Appendix B, Electronic Copy of Groundwater Data Trend Viewer (Excel Pivot):** The y-axis for all parameters is presented as micrograms per liter (µg/L); however, the field parameters included in this

table are not reported in µg/L. Revise Appendix B to include appropriate units of measurement for each parameter.

Response

A limitation of the Excel pivot table graphical plots is posting of a single label of axes – micrograms per liter was chosen for the y-axis label although it of course does not apply to the general field parameters. We can provide the units of measurement for each field parameter as an added worksheet to the Excel file.

7. **Depth To Water (DTW):** In order to present the most accurate and up to date GW flow for each hydrogeologic unit in the upcoming RI, EPA requests that the next sampling event also focus on obtaining as much DTW data as possible and present it in the RI.

Response

There is ample DTW data for this site from the abundance of past sampling events and DTW measurements – a position to which was agreed by the EPA and Georgia EPD during the workplan development for the 2017 site-wide sampling event. However, DTW measurements can be made in the upcoming CBP semi-annual monitoring event (involving the 'D' wells).

8. ***All COCs:*** *There appears to be very high concentrations of all COCs at or near MW-111, no horizontal extent demonstrated north/northeast/northwest/east. EPA requests that the data gap be addressed by the next sampling event.*

Response

Well MW-111 is located at the northern edge of the site property, along the uplands/marsh border in immediate proximity to the former Brunswick-Altamaha Canal. A former dump site operated by the County is to the north of this well. The "Dillon Duck" wetlands basin and the former theater pond are located to the east, and further to the east are well locations MW-314 (to northeast) and MW-108 (to southeast).

MW-111 is characterized by a moderate to low mercury condition (the 'A' well is the highest with a 2017 event result of 3.5 ppb) which has been trending downward over the long period of monitoring, a condition attributed to former placement of bleach muds in this area removed in the 1994-97 Removal Action. Higher concentrations of petroleum hydrocarbons such as PAHs, trimethylbenzene, and benzene occur at MW-111 attributed to former placement of petroleum refinery sludge also removed in the Removal Action. This condition resulting from the sludge is prevalent along much of the uplands/marsh shoreline and the horizontal extent to the west (downgradient) is characterized by well transects south of MW-111 such as MW-302>>MW-308>>MW-310 and MW-110>>MW-303>>MW-309>>MW-311 where the downgradient wells exhibit trace to non-detect COC levels.

9. ***All COCs:*** *There appears to be exceedances of many COCs at or near MW-116, no horizontal extent demonstrated south and east. The data gap should be addressed by the next sampling event.*

Response

It is unclear which COC exceedances are referenced in this comment. MW-116 is located at the far southern end of the property away from any of the former operational areas, and based on our review of the 2017 site-

wide sampling event results only Naphthalene exceeds its RSL but is at a very low concentration (0.2 ppb well MW-116A). We see not data gap here.

10. ***Metals:*** *There appears to be consistent exceedances at MW-356B, no upgradient delineation. Status and interval of MW408 unknown - no results in pivot table. EPA requests that the data gap be addressed by the next sampling event.*

Response

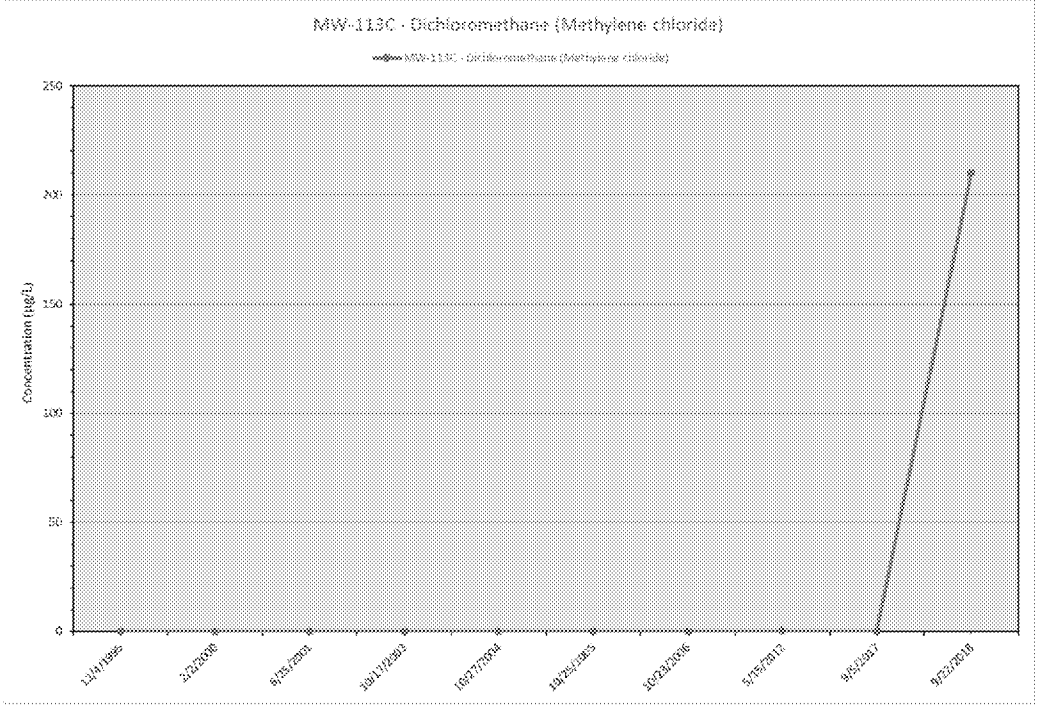
Note that two well cluster locations (MW-362A, B and MW-355A, B) occur upgradient to MW-356. No data gap exists.

The 400-series labeling on the Figure was an oversight, as this convention was used in the June 2001 sampling event for the blind duplicate sampling; it does not represent a unique monitoring well location (and therefore those labels will be omitted from the figure).

11. ***Dichloromethane:*** *High concentration (213 - >MCL) detected at MW-113C in 2018, no upgradient delineation. EPA requests that the data gap be addressed by the next sampling event.*

Response

Dichloromethane (Methylene Chloride) is a well-known laboratory cross-contaminant. See the graph below for the time series monitoring record for Dichloromethane at well MW-113C where it is apparent the 2018 measurement is a data anomaly that can be attributed to laboratory contamination.



12. ***Naphthalene and Arsenic >RSL at MW-359B in 2018; MW-117B not sampled in 2018.*** *EPA requests that the data gap be addressed by the next sampling event.*

Response

Well location MW-359 is located in the south-central portion of the site and is bordered to the east (up-gradient) by MW-117, to the north (side-gradient) by MW-115, to the south (side-gradient) by MW-116, and to the west (down gradient) by MW-113. The relevance of MW-359B exhibiting a concentration about an RSL is unclear given wells border this location in all directions.

MW-117 is one of the site up-gradient well locations (along with to the north MW-108 and MW-107). It was not sampled in 2018 as there was no purpose in this location being sampled – the 2018 sampling was specific to the CBP Phase 4 activity far removed from the MW-117 area.

13. ***Naphthalene>RSL at MW-113C in 2018; MW-116C not sampled in 2018.*** *EPA requests that the data gap be addressed by the next sampling event.*

Response

Well location MW-113 is surrounded by wells in the side-, up- and down-gradient directions so the relevance of this location exceeding the Naphthalene RSL in 2018 is unclear.

MW-116 is located at the far southern end of the site (like MW-117 addressed in the previous comment), and was not a location of interest pertinent to the 2018 sampling objectives.

DRAFT COMMENTS PROVIDED BY THE GEORGIA ENVIRONMENTAL PROTECTION DIVISION ON THE SITE CHARACTERIZATION SUMMARY REPORT OPERABLE UNIT 2 (OU2) SITE-WIDE GROUNDWATER AND CELL BUILDING AREA FOR THE LCP CHEMICALS SITE, BRUNSWICK, GEORGIA DATED FEBRUARY 2020

There is no "Public Practice of Geology" certification in the document, as required by O.C.G.A. 43-19-3 and 26. The certification should read:

"I certify that I am a qualified groundwater scientist who has received a baccalaureate or post-graduate degree in the natural sciences or engineering, and have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, that enable me to make sound professional judgements regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by myself or a subordinate working under my direction."

Document also needs to be accompanied by the signature and seal of a GA registered Professional Geologist.

Response

Future submittals will contain this certification.

2) Acronym list needs to be added to the document.

Response

Future report submittals will provide an acronym list.

3) For consistency with the Mutch documents and reports, the Ebenezer Member #5 layer should be referred to as a variably cemented sandstone.

Response

Noted.

*4) **Section 3.2.3.3** – Ebenezer Member #2 (former Coosawhatchie C should be referred to as a semi-confining unit to be consistent with the figure on pg. 10 of the document.*

Response

Noted.

*5) **Section 4.1.2.6**, 4th sentence – reads "Five samples...were collected from borings SB-483 and SB-483..." Based on the bullets that follow, this likely should read "...borings, SB-482, SB-483 and SB-480..."*

Response

Agreed.

6) ***Section 4.2.1****, 2nd paragraph, 1st sentence, pg. 19 – is 12 "Numerous"?*

Response

The sentence read "numerous additional monitoring wells were installed beneath the cemented sandstone layer", meaning the well network for that aquifer grew from 7 'D' wells to included 12 additional 'HW' wells. The word 'numerous' can be struck and the same general message will be conveyed.

7) ***Section 4.2.2****, 1st full paragraph, last two sentences, pg. 20 – this is misleading and inaccurate. If it were, the Arsenic levels in* ***Table 4-2c*** *would not be mostly non-detect.*

Response

Arsenic levels in Table 4-2c are mostly non-detect, with 6 detections out of 23 samples (74% non-detect). Therefore, the sentences are accurate.

8) ***Section 4.3.2****, 5th and 6th sentences – this is unclear; how were five locations (NAPL-1 to NAPL-5) "assessed for the presence of NAPL…" if only four temporary monitoring wells (NAPL-1, NAPL-4, NAPL-4A and NAPL-5) were installed? What about locations NAPL-2 and NAPL-3?*

Response

Field screening for the potential presence of NAPL was performed at each soil boring location, and if any field indicators were positive, a temporary well was installed to test for the presence of mobile NAPL. Four of five boring locations exhibited some form of field screening indicative of potential NAPL, thus wells were installed at the four locations.

9) ***Section 4.3.6****, 4th sentence – should be "SSE" rather than "SEE", for consistency with pages 19-20.*

Response

Agreed.

10) ***Section 5.3.2.2*** *– the RI report must address how naphthalene "…is detected in a majority of the monitoring wells with two of the horizontal wells reporting naphthalene at 1-10X above the MCL…" below the variably cemented sandstone layer.*

Response

Comment noted: the OU2 RI report will provide additional discussion regarding the naphthalene distribution including below the sandstone layer.

11) ***Section 5.4.1****, last two sentences – references must be provided to support the inference that As and Cr "…are common along the Georgia coast…" and that "…the presence of heavy metals is confirmed…" when the spectroscopic analysis identified only iron pyrites.*

Response

Comment noted: the OU2 RI report will provide additional discussion regarding the natural occurrence of As and Cr in the site soils (aquifer matrix).

*12) **Section 5.4.2.3**, 1st paragraph, last sentence – "layer", not "lower"*

Response

Noted.

*13) **Section 5.4.2.6**, 2nd paragraph – a full treatment of the disparate behavior of Se vs other metals in response to the CBP treatment will be required.*

Response

Comment noted: the OU2 RI report will provide additional discussion regarding the behavior of Se in response to the CBP treatment.

*14) **Section 5.5.2.2** – inconsistent with the four-regime groundwater CSM presented in the 1997 RI (**Fig 4.4-13**), which shows meteoric, estuary-affected brackish, salt release (raw material) and CBP Ground Water. Although this figure discusses TDS, another figure shows the four regimes differentiated by Na content, which showed the difference between estuarine brackish and NaCl (but not NaOH) releases.*

Response

It is not apparent to us how Section 5.5.2.2 is inconsistent with or causes an issue with prior CSM concepts. As noted, Figure 4.4-13 of the 1997 RI Report is specific to TDS and does not map/model sodium which was completed in the current report. Therefore, a one-to-one comparison is not pertinent. The purpose of Section 5.5.2.2 is to detail the concentration profile of sodium, an indicator of past caustic and brine release, and how the condition has change spatially and temporally. No further conclusions, including groundwater regimes, are discussed or forecast in the current Na model but may be discussed in the forthcoming RI if warranted.

*15) **Section 6.2.3** – the new hypothesis regarding "solubilized organic matter" must be supported with references and fleshed out in the RI, as it may have a bearing on mobility of dissolved metals.*

Response

Noted.

*16) **Fig 2.6** – shows two CO_2 injection points inside the Drive-In Theater Pond.*

Response

This was a database query error (query also captured the two Surface Water (SW) sample locations – figure will be fixed for future submittals.

*17) **Fig 5.2—5.4, 5.8** – these figures show a misleading depiction of groundwater contamination, in that ND levels above the MCL are color coded as ND rather than the concentration range to which they properly*

belong. This markedly changes the graphical depiction of benzene contamination on Fig 5.2B and C, chlorobenzene on Fig 5.3C, and dichloromethane on Fig 5.4B and C and Arsenic levels on Figure 5.8C-D. Please check re-check all Figures regarding the Current Nature and Extent of the Site Groundwater Condition.

Response

The figures depict non-detect results with a '<DL value' convention where the value is the detection limit, and in some instances the DL is above the first range of the detected concentrations as shown in the legend. We can revise figures to label wells characterized by a non-detected result as 'ND' to avoid any confusion.

*18) **Fig 5.12A** – the ND indicators on this figure are missing.*

Response

The figure is correct as shown. Low-level analytical methods were employed for mercury analysis, thus most locations report some level of trace detection.

*19) **Fig 5.12E** – this appears to be inconsistent with Fig 5.12B and C.*

Response

We do not observe any inconsistencies between Figure 5.12E with Figures 5.12 B and C.

*20) **Appendix B** – Groundwater Data Trend Viewer – numerical values are not shown for some constituents (i.e. Arsenic Figures). Some constituents show an increasing trend in values and/or have a limited number of data points. For example, MW-362B for mercury has 3 data points, the last sample occurring on 9/11/2019 at a value of 21.1 ug/L. Increasing trends in pH are observed in some wells such as MW-101D, MW-115D, MW-301B, MW-361B, some which have values approaching or over 10.5.*

Response

The inconsistencies in labeling of numerical values is a quirk within Excel (graphs are not intended to also post numerical values) that cannot be fixed.

Please note that wells MW-361A,B and MW-362A,B were only installed in 2019, as part of the Phase 4 CBP response.

The reviewer can consult the revised viewer (which provides normalized concentration axis worksheets) regarding interpretation of temporal trends. Trend evaluation will be part of the OU2 RI Report.

RI Monitoring Well Network: Satilla Formation

MW-314A,B
MW-111A,B,C
MW-301A,B
MW-310A,B
MW-308
MW-302
MW-311A,B
MW-109A,B,C
MW-108A,B,C
MW-309
MW-110A,B,C
MW-303
MW-101A,B,C
MW-102A,B,C
MW-103A,B,C
MW-104A,B,C
MW-105A,B,C
MW-352A,B
MW-106A,B,C
MW-107A,B,C
MW-361A,B
MW-354A,B
MW-353A,B
MW-351A,B
MW-312A,B
MW-358A,B
MW-357A,B
MW-362A,B
MW-356A,B
MW-355A,B
MW-305
MW-132
MW-132A,B,C
MW-133
MW-131
MW-304
MW-115A,B,C,D
MW-135
MW-313A,B
MW-113A,B,C
MW-117A,B,C
MW-359A,B
MW-306A,B
MW-307A,B
MW-114A,B,C
MW-116A,B,C

RI Monitoring Well Network: Ebenezer Formation

MW-108D
MW-101D
HWWest1
HWEast1
HWWest2
HWEast2
MW-352D
HWWest3
HWEast3
MW-358D
MW-360D
HWWest4
HWEast4
MW-115D
HWWest5
HWEast5
HWWest6
HWEast6
MW-117D

CBP Performance Monitoring Wells and Extraction Wells

MW-503A,B
EW-3
MW-505A,B
EW-2
MW-502A,B
MW-501A,B
EW-5
MW-510A,B
EW-12
EW-1
MW-509A,B
MW-506A,B
MW-514A,B
EW-7
MW-508A,B
MW-504A,B
EW-4
MW-513A,B
EW-13
MW-507A,B
EW-6
MW-511A,B
EW-9
MW-518A,B
EW-8
MW-512A,B
MW-515A,B
MW-517A,B
MW-516A,B
MW-1C,2C
EW-10
MW-519A,B
EW-11

N

0 400 800
Feet

Monitoring Well
Horizontal Well
Extraction Well
CO_2 Pilot Monitoring Well
Upland Boundary

LCP Well Network: RI Monitoring Wells and CBP Performance Monitoring Wells

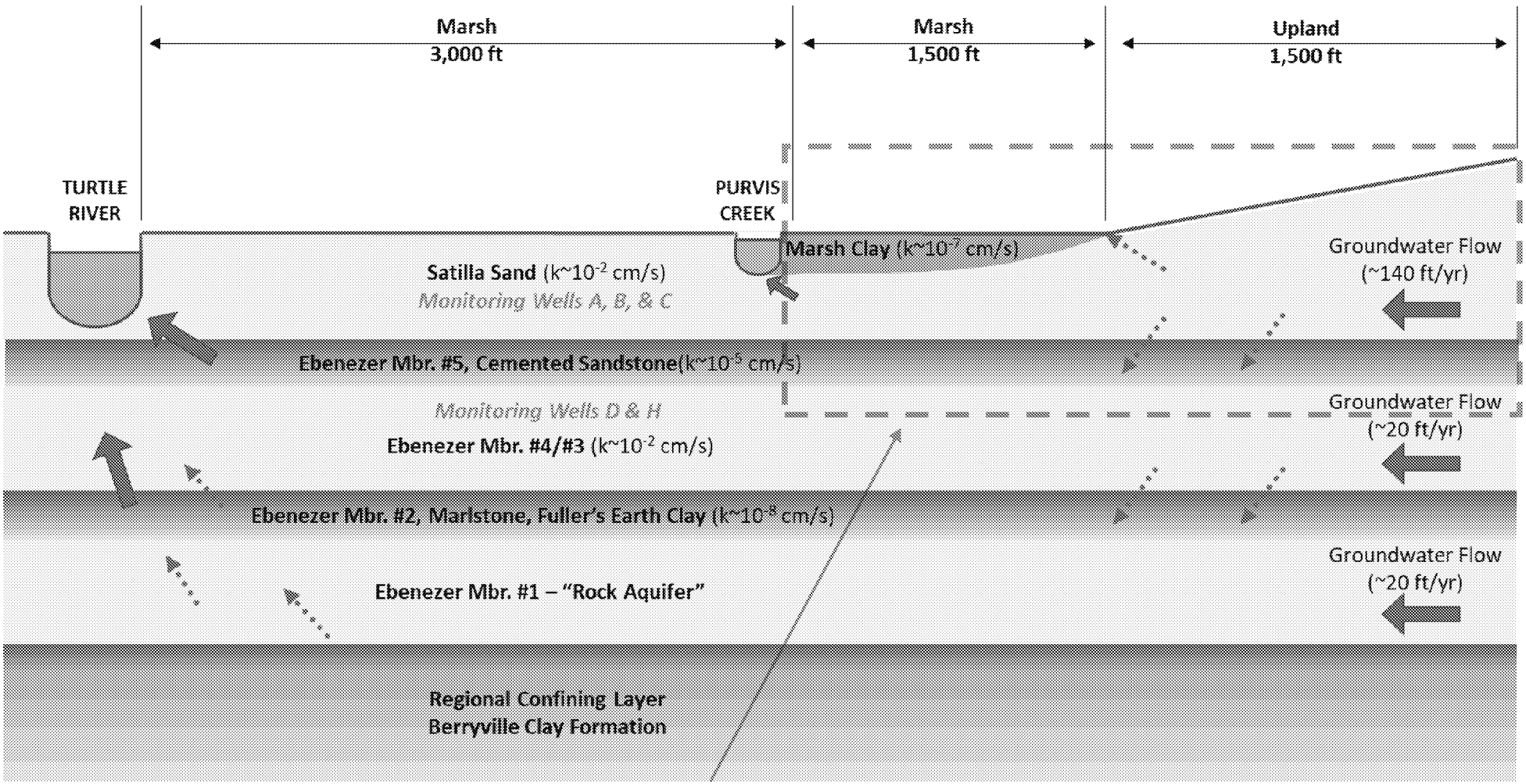
LCP Chemicals Site
Brunswick, GA

Environmental Planning Specialists, Inc.

Figure No. 4.1

ED_006371_00001834-00015

Local Area Cross Section



Scope of Prepared X-Sections

Transect A-A'

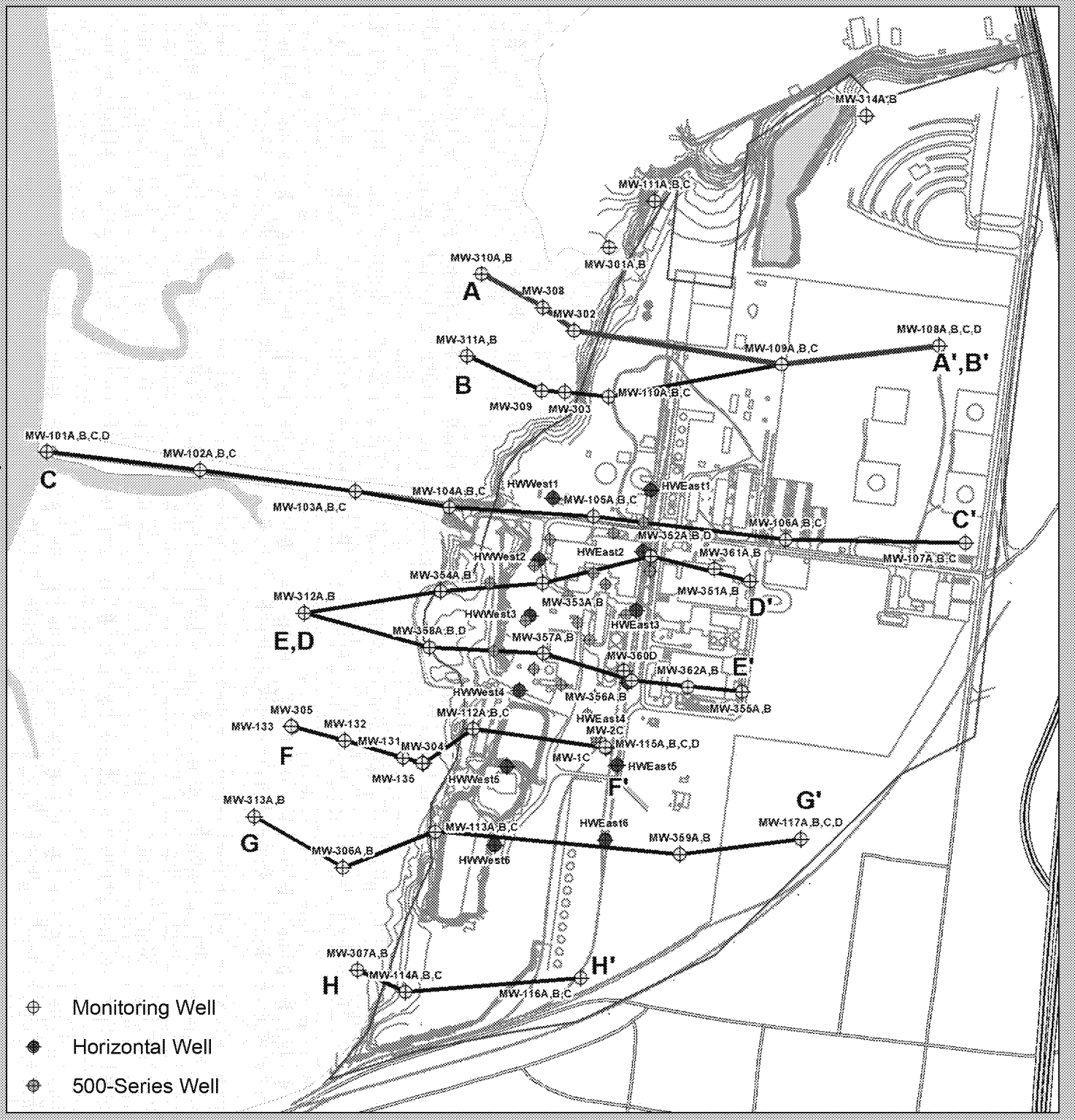
MW-108A,B,C,D
MW-109A,B,C
MW-302
MW-308
MW-310A,B

<u>As, Cr, Se, V & Naphthalene:</u>

- Condition noticeably more elevated in wells bordering former Brunswick Altamaha Canal (petroleum sludge formerly disposal)
- Metal MCL/RSL exceedances limited to MW-302
- Naphthalene RSL exceeded across the transect

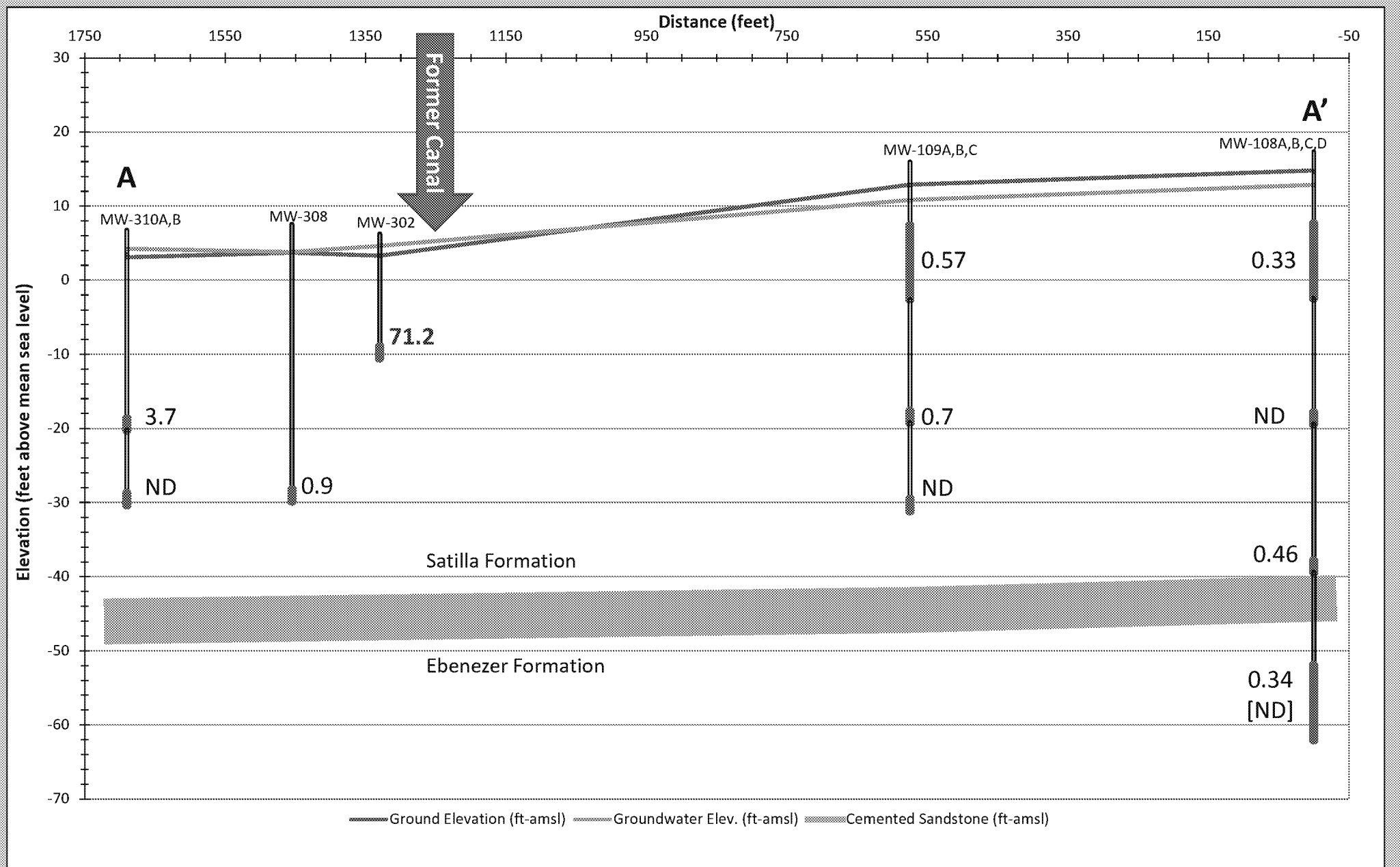
<u>Hg:</u>

- Max detect 0.5 µg/L



Transect A-A'

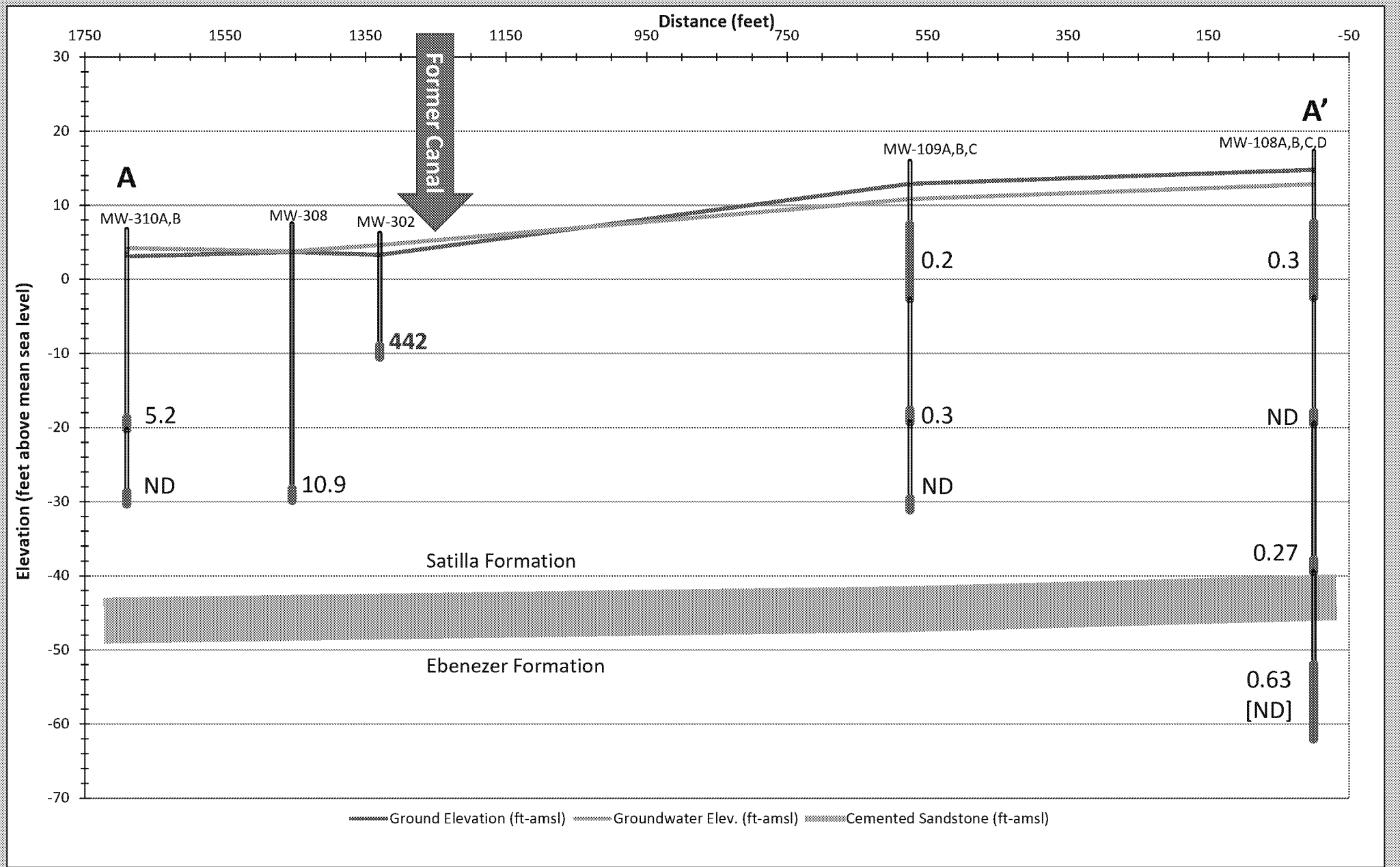
2017 Arsenic MCL: 10 µg/L



[2019 Testing Result]

Transect A-A'

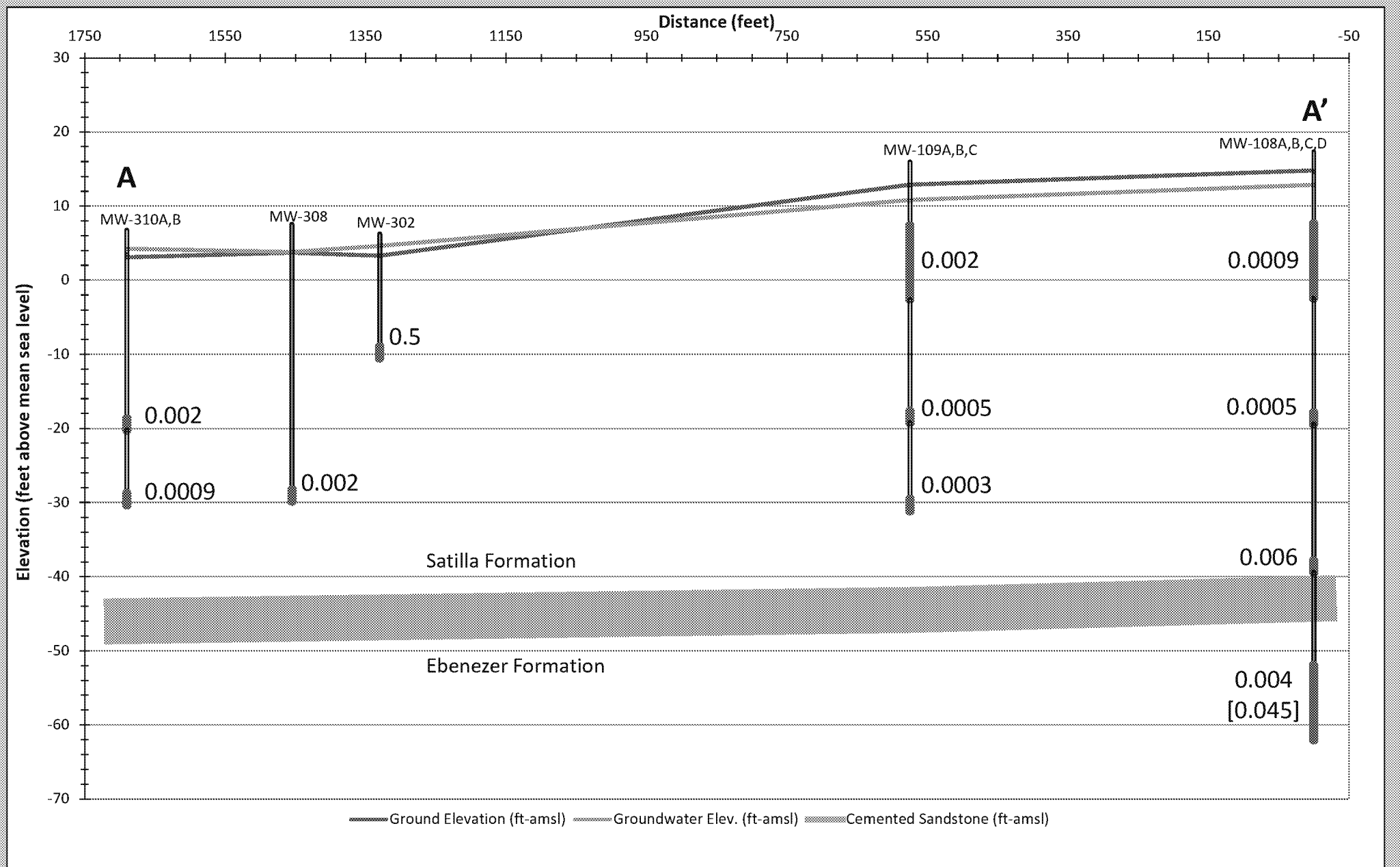
2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]

Transect A-A'

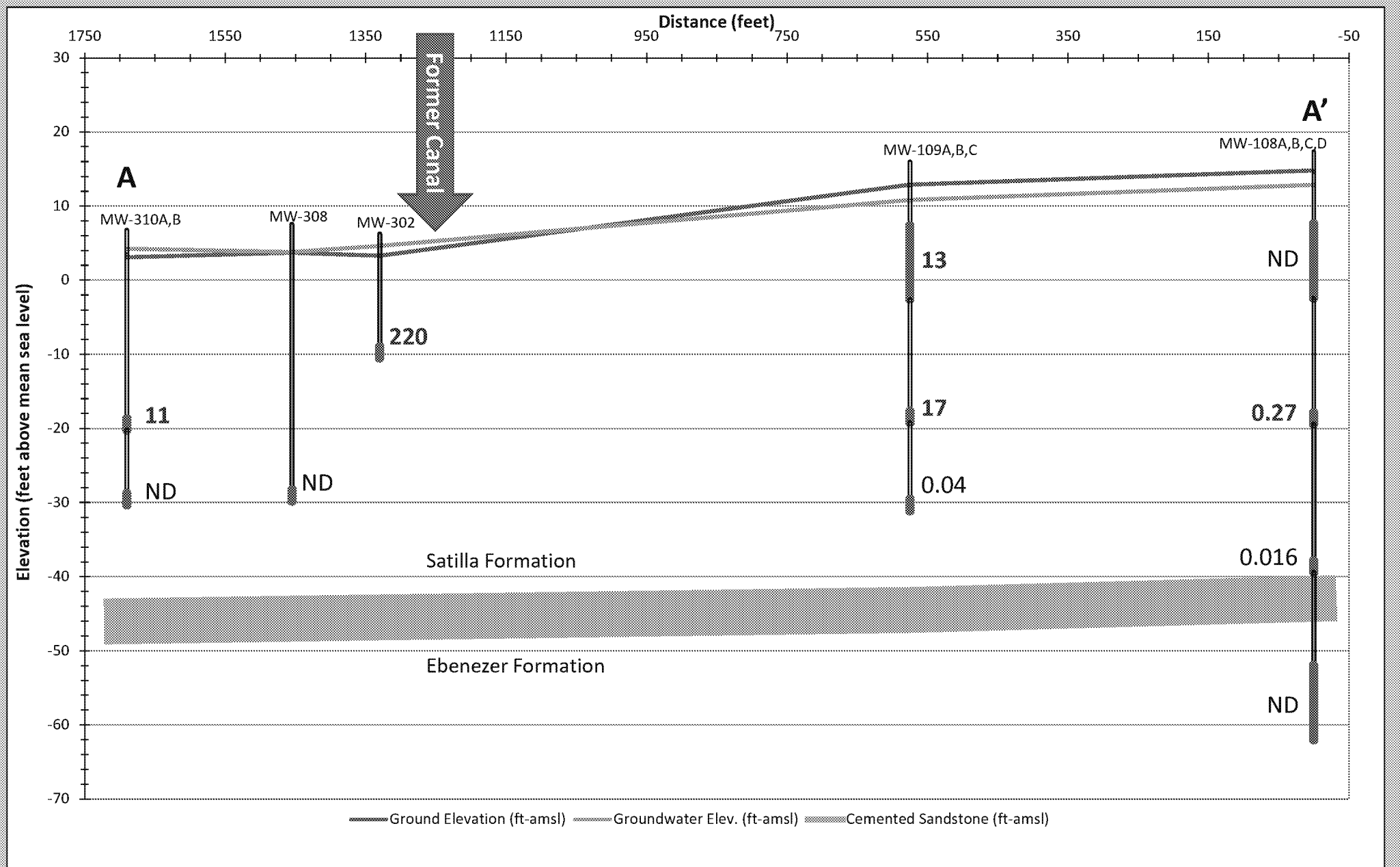
2017 Mercury MCL: 2 µg/L



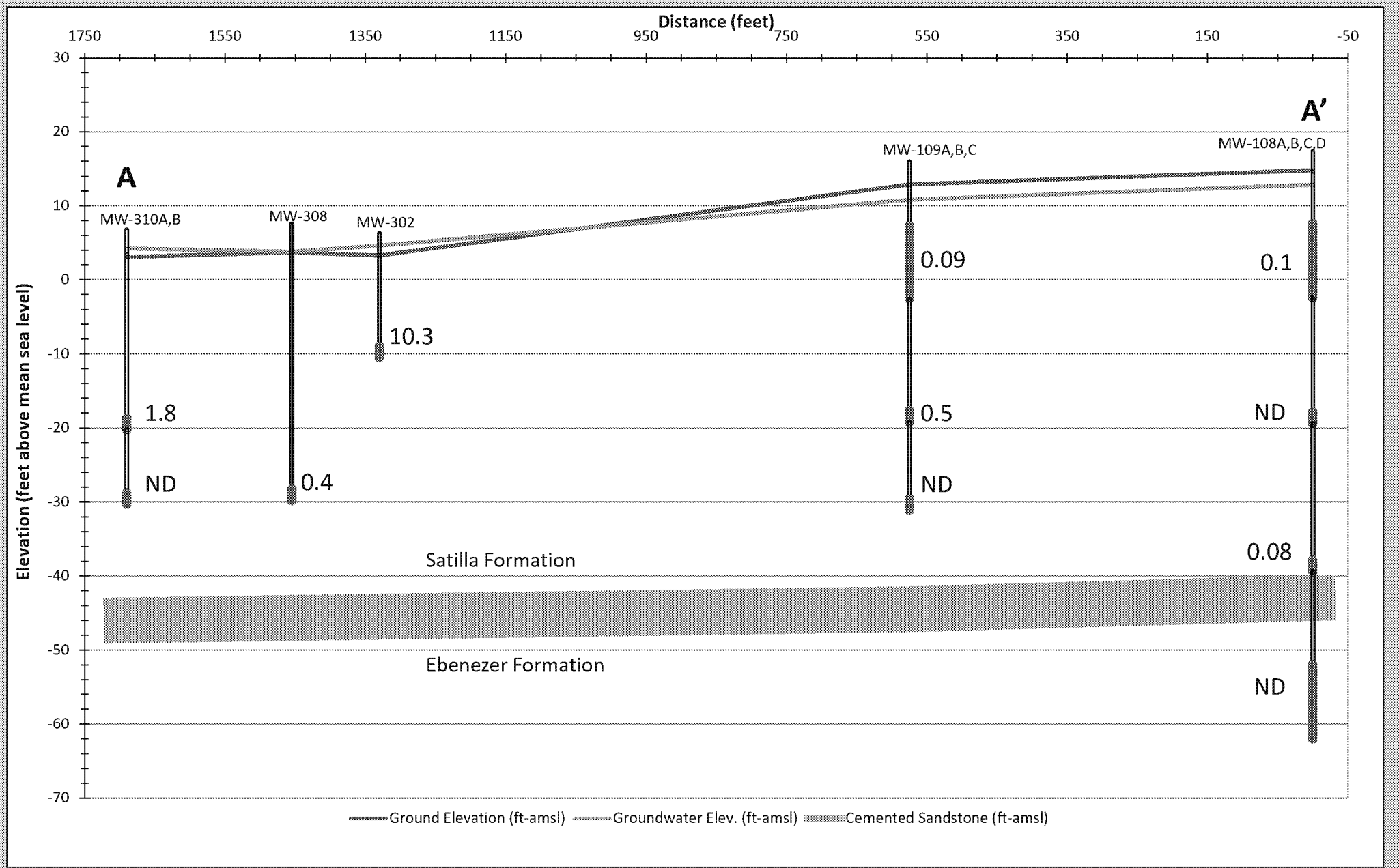
[2019 Testing Result]

Transect A-A'

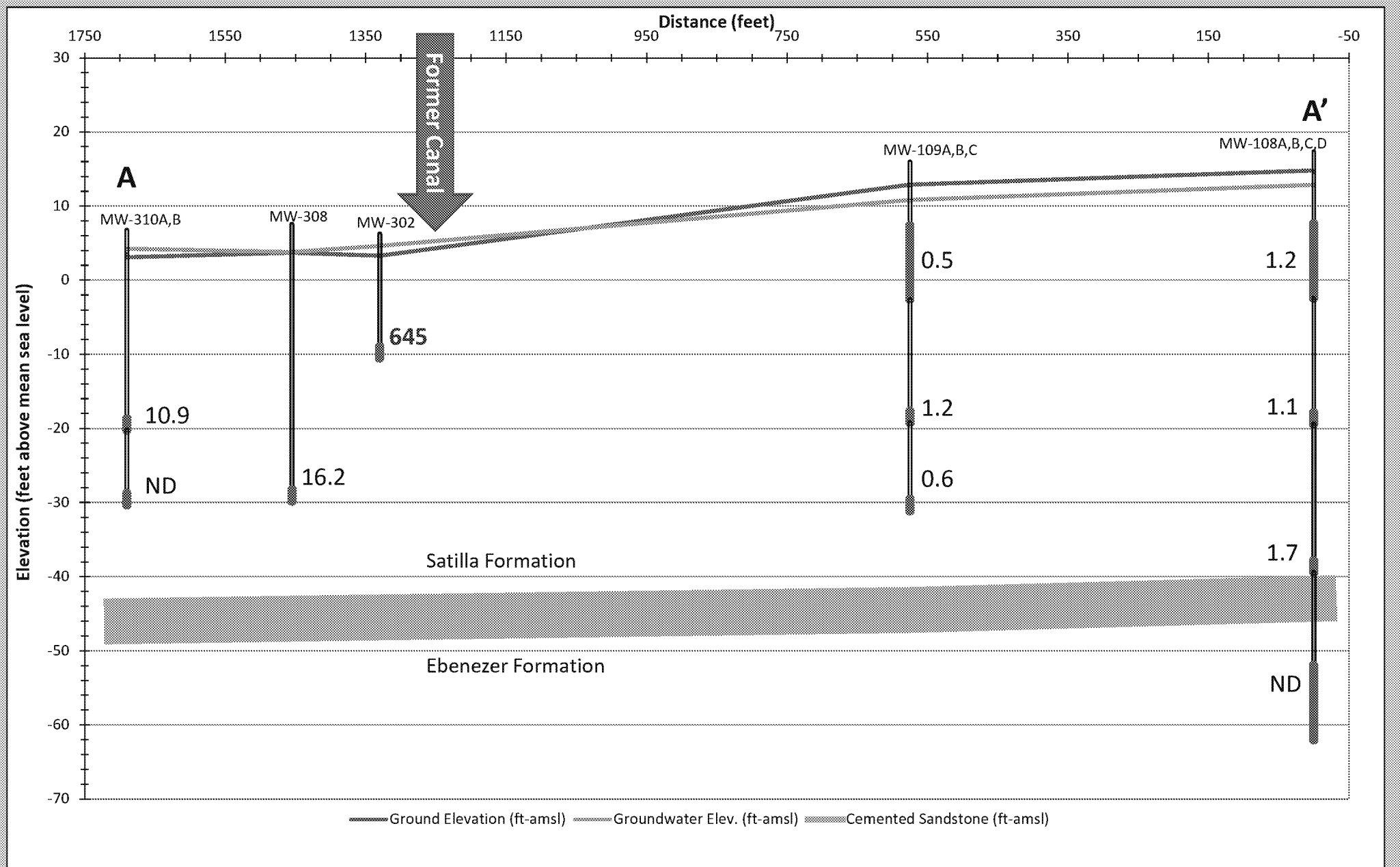
2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



Transect A-A'
2017 Selenium MCL: 50 µg/L



Transect A-A'
2017 Vanadium RSL: 86 µg/L



Transect B-B’

MW-108A,B,C,D
MW-109A,B,C
MW-110A,B,C
MW-303
MW-309
MW-311A,B

Cr & V:

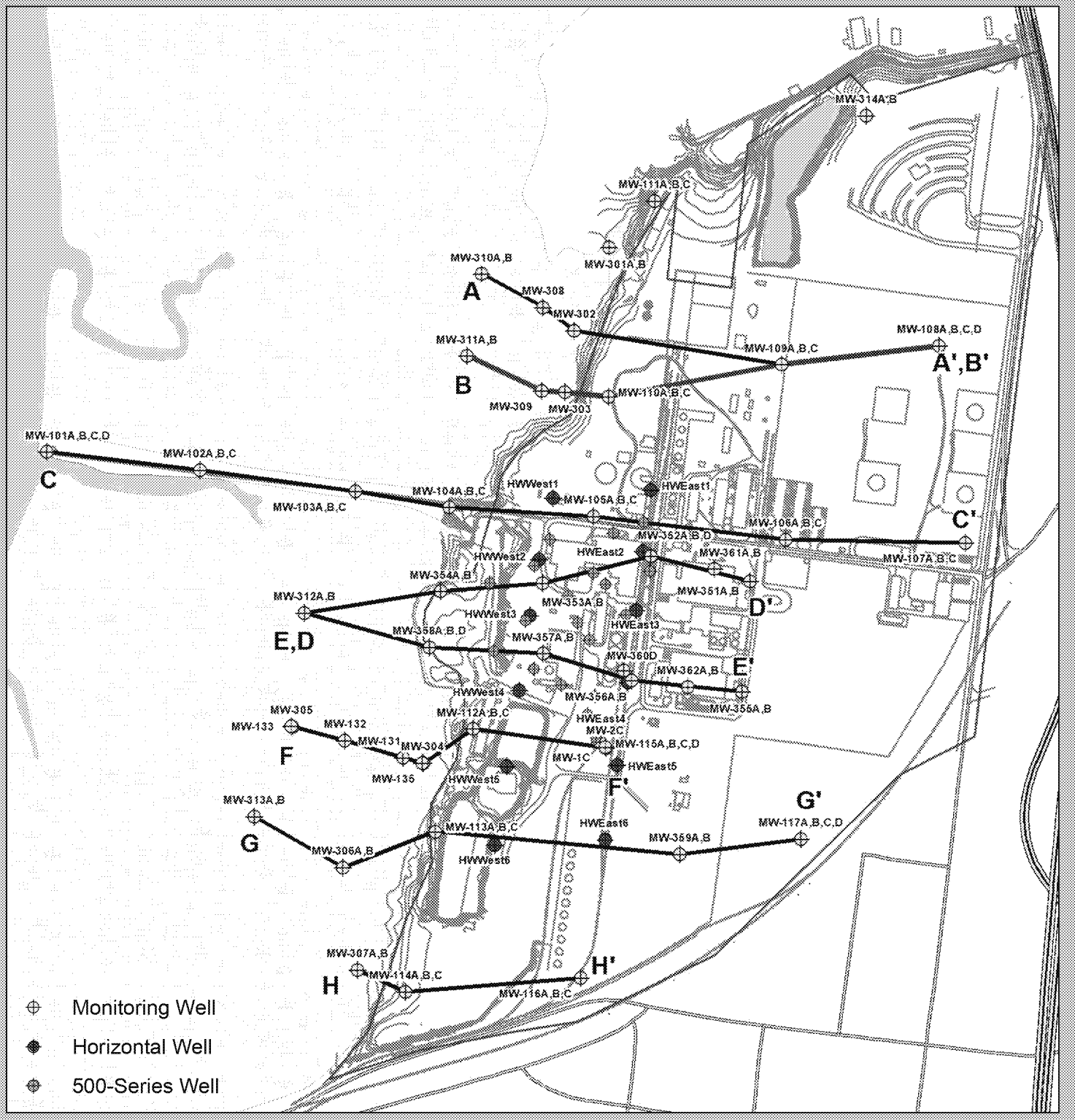
- Marsh bordering wells higher concentration (canal)
- No conditions exceed MCL/RSL

As, Hg & Se:

- No conditions exceed MCL/RSL

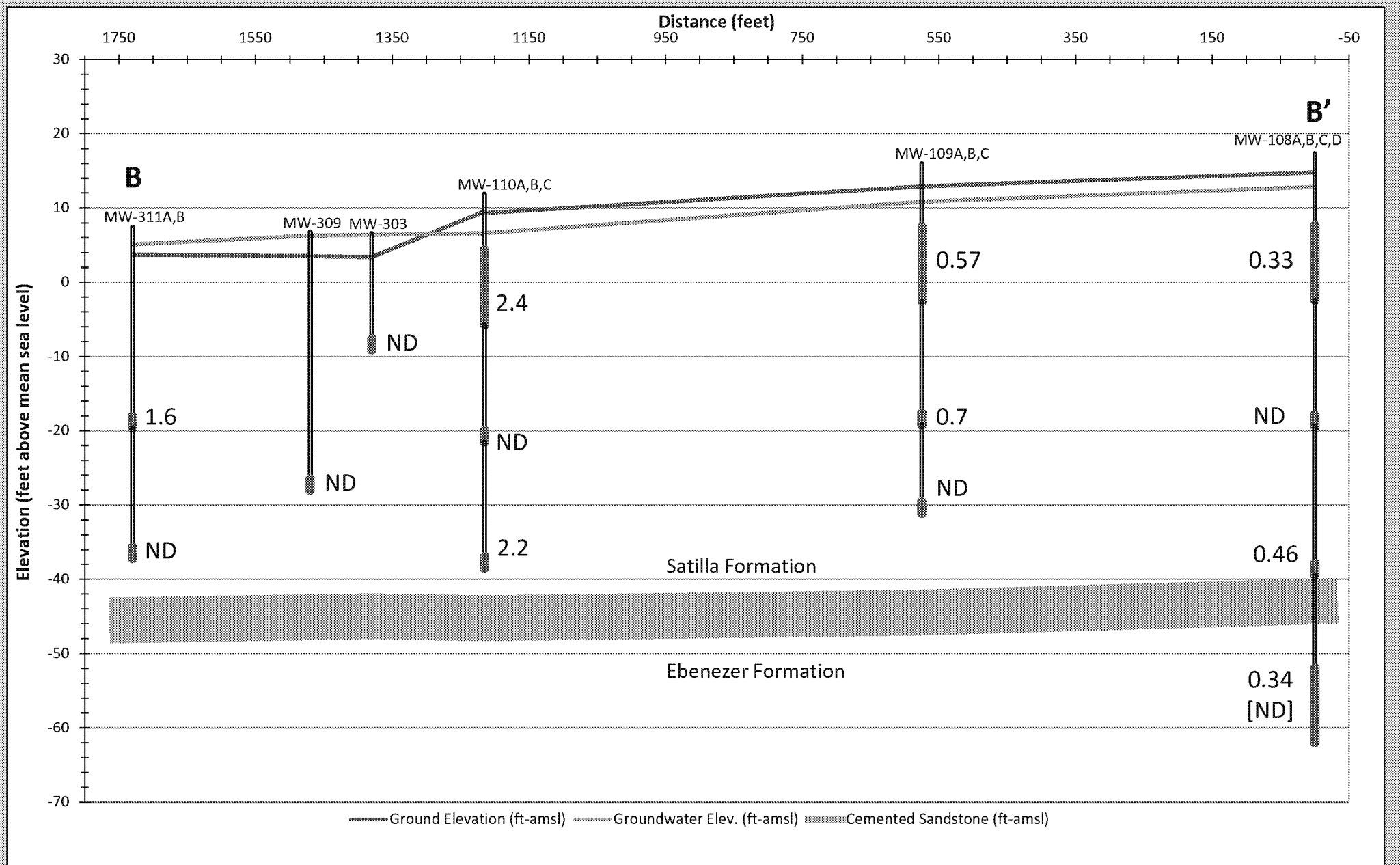
Naphthalene:

- Marsh bordering wells higher concentration (canal)
- Naphthalene RSL exceeded across the transect except outer marsh well (MW-311A/B)



Transect B-B’

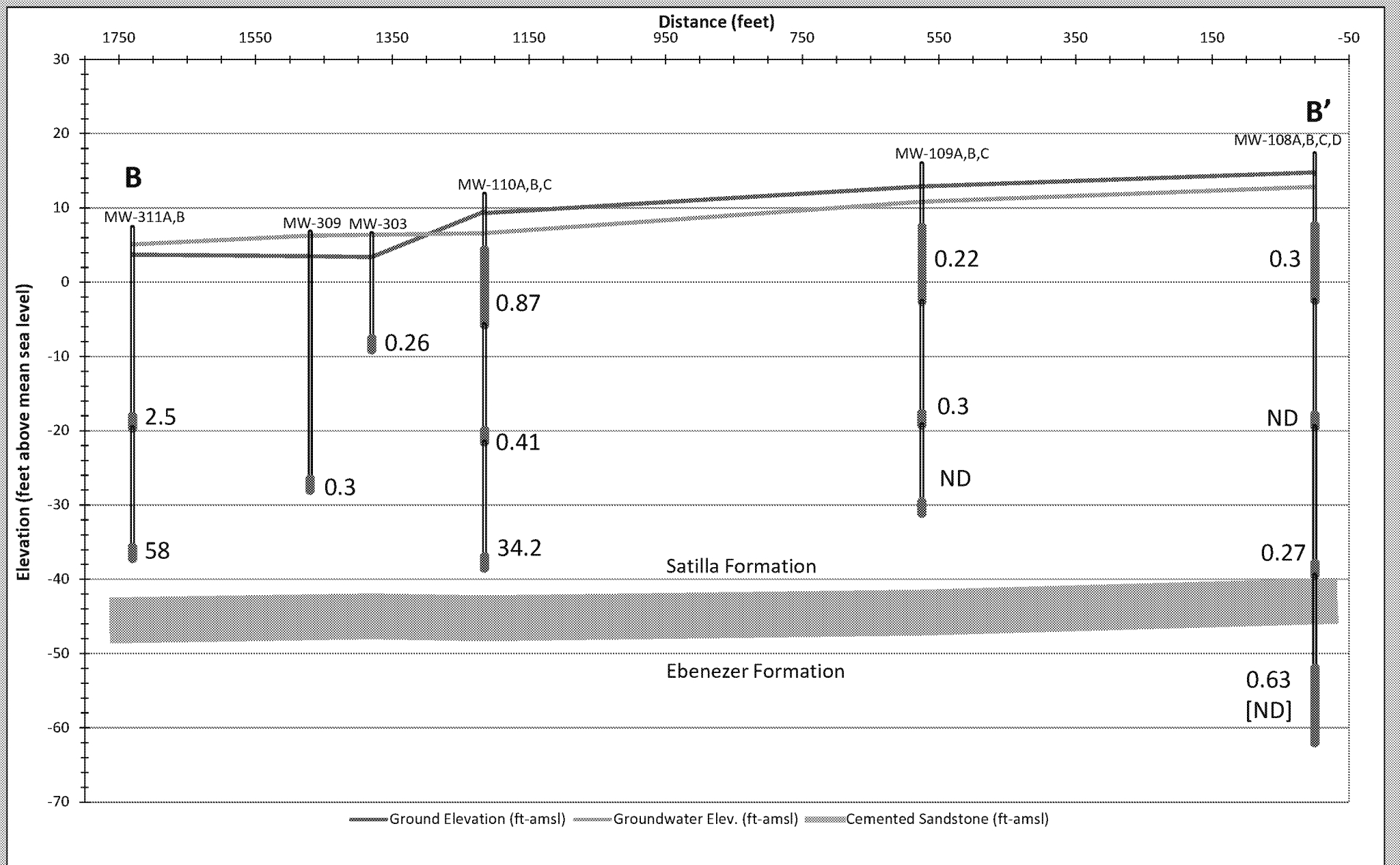
2017 Arsenic MCL: 10 µg/L



[2019 Testing Result]

Transect B-B'

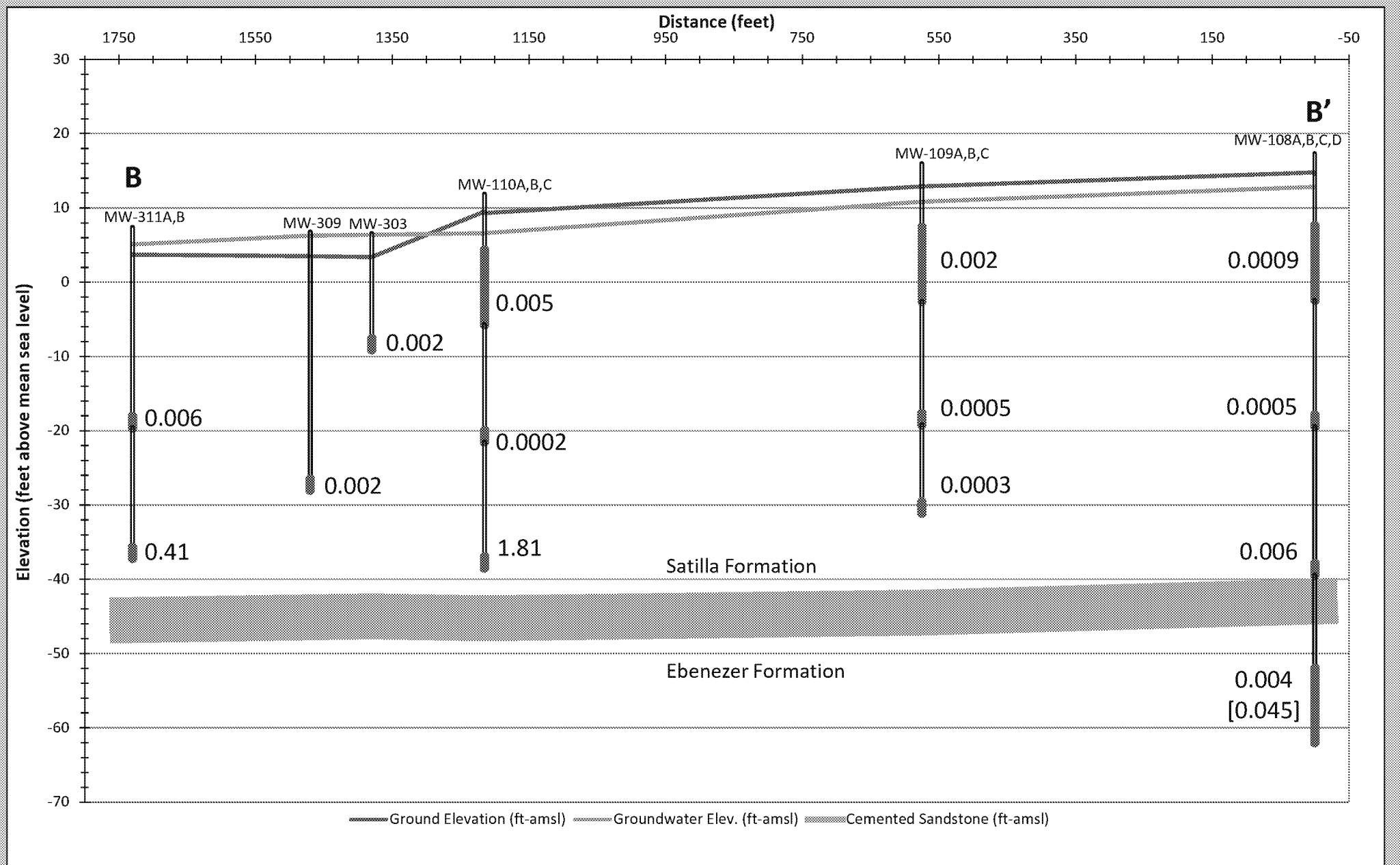
2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]

Transect B-B'

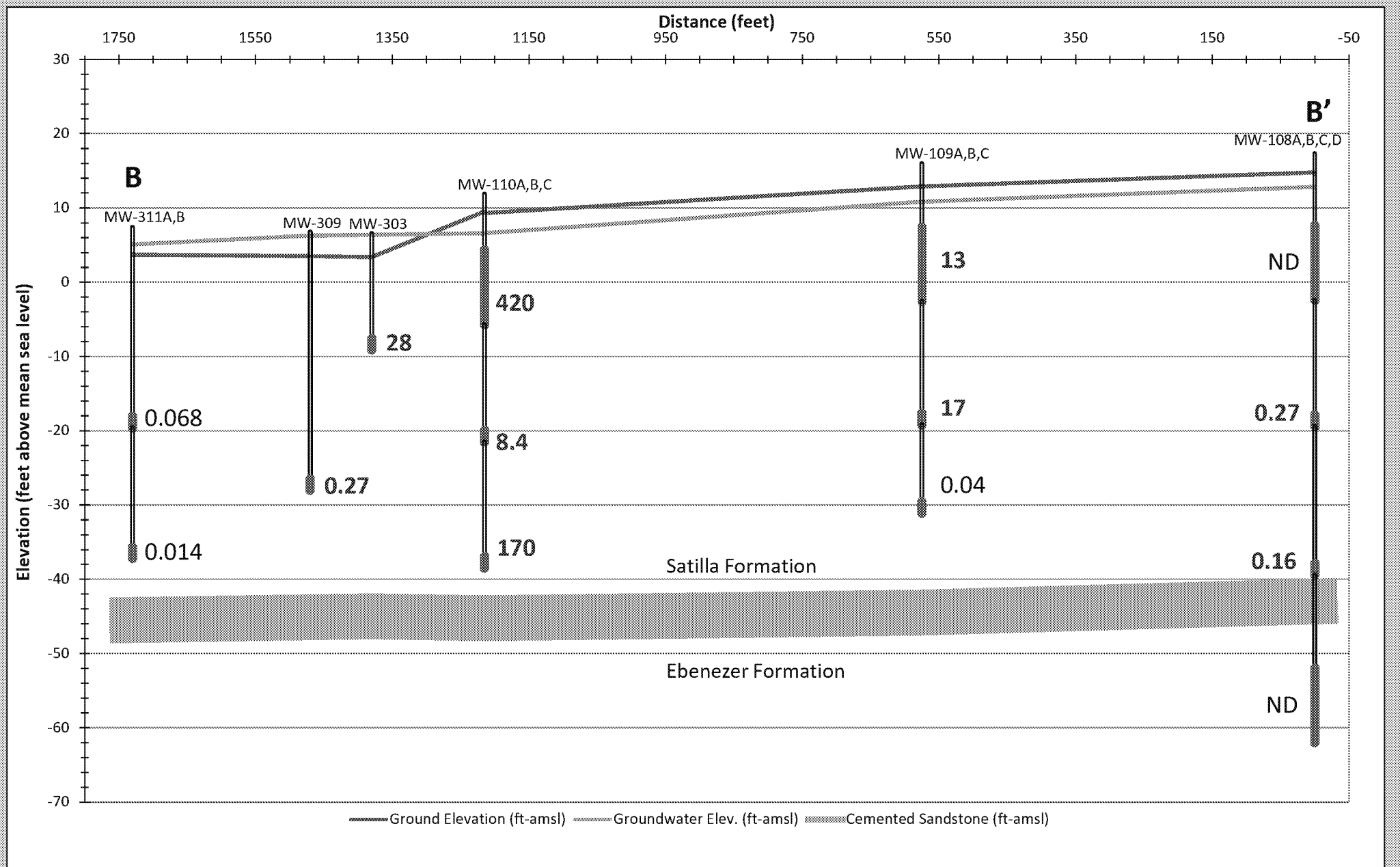
2017 Mercury MCL: 2 µg/L



[2019 Testing Result]

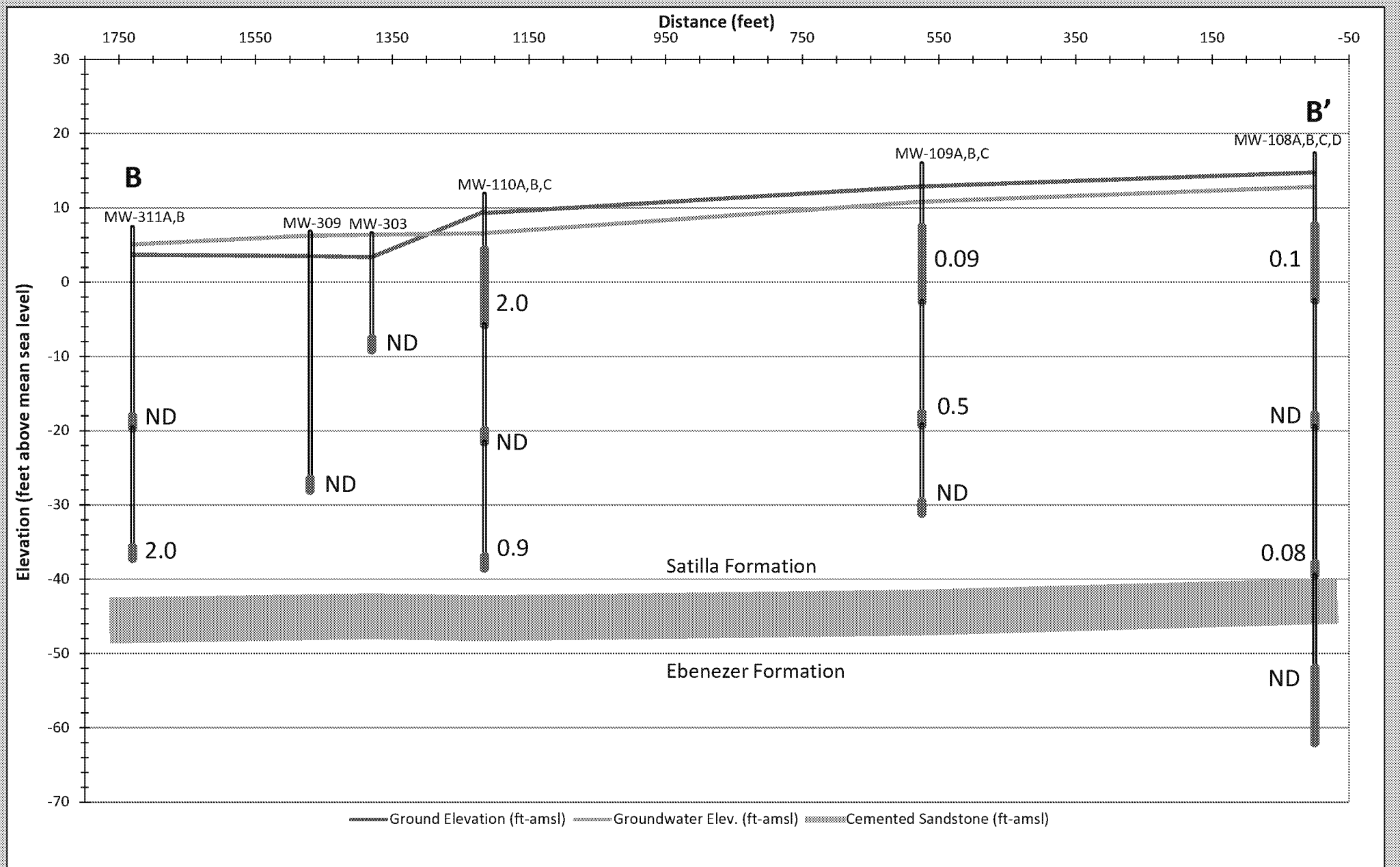
Transect B-B'

2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



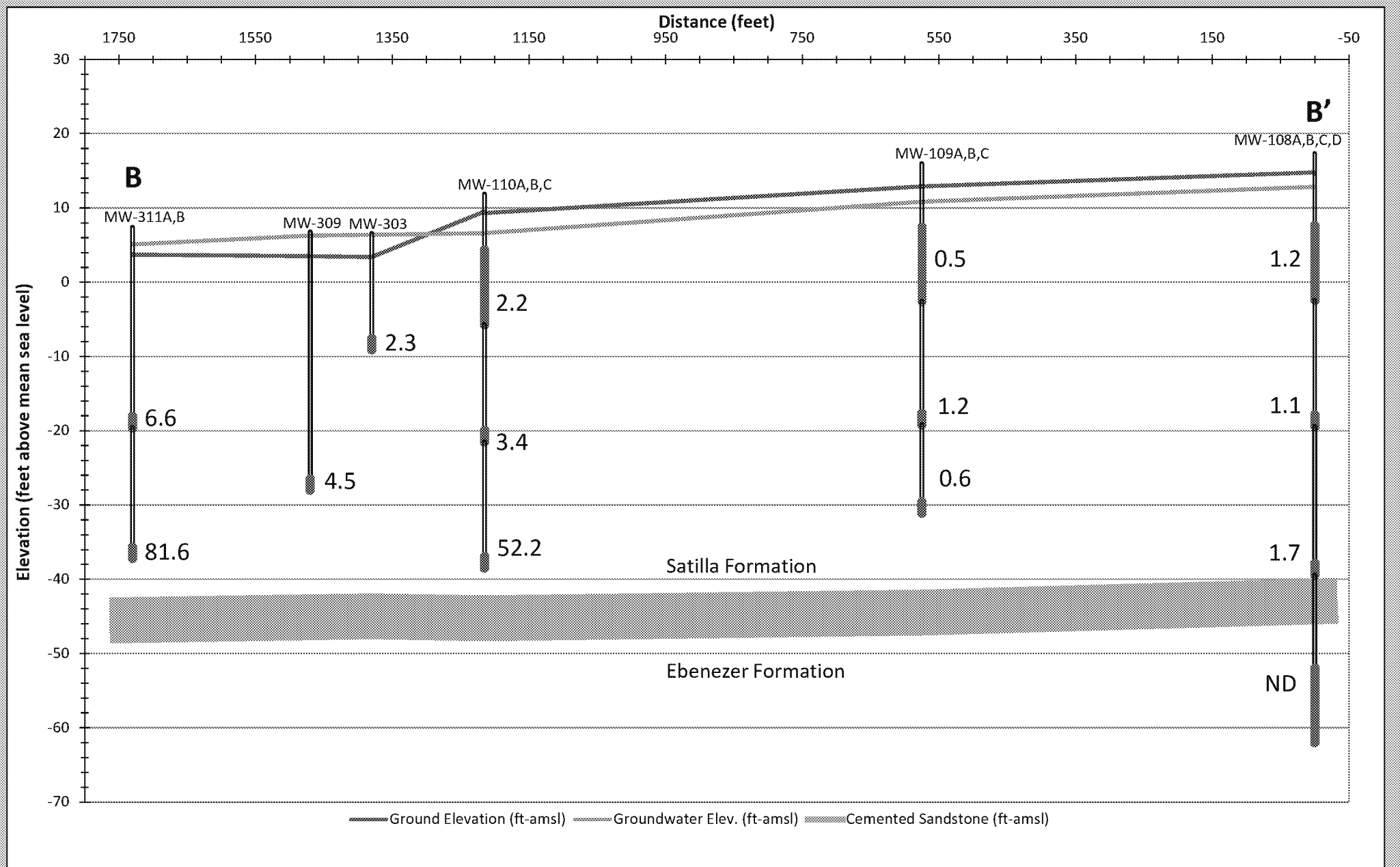
Transect B-B'

2017 Selenium MCL: 50 µg/L



Transect B-B'

2017 Vanadium RSL: 86 µg/L



Transect C-C'

MW-107A,B,C
MW-106A,B,C
MW-105A,B,C
MW-104A,B,C
MW-103A,B,C
MW-102A,B,C
MW-101A,B,C,D
HWWest1
HWEast1

<u>As, Cr, Se</u>

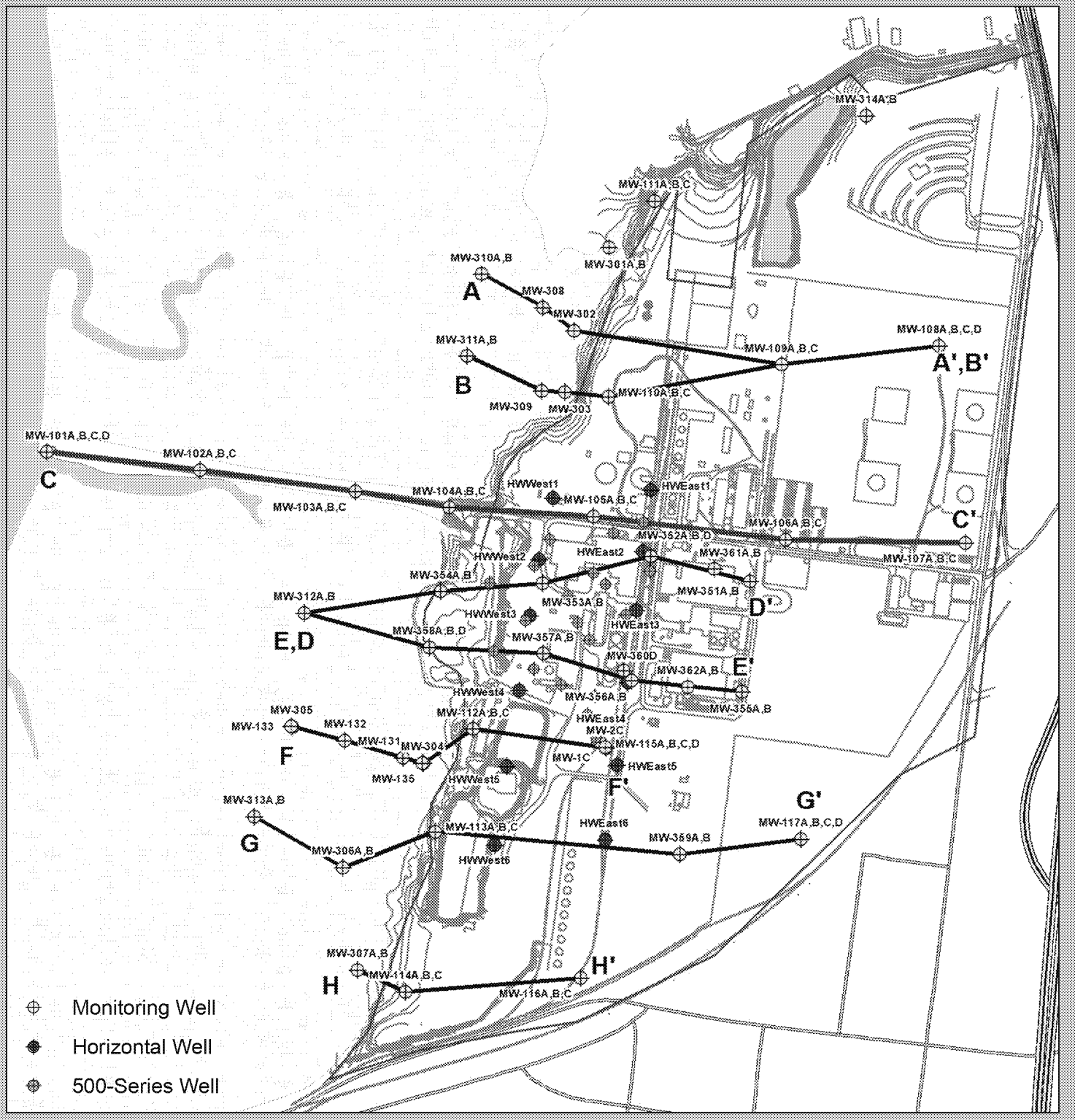
- Concentrations all below MCL/RSL

<u>Hg, V</u>

- Concentration in HWWest 1 slightly exceed MCL/RSL
- In general, no compelling concentration gradients but slightly higher concentrations observed near CBA

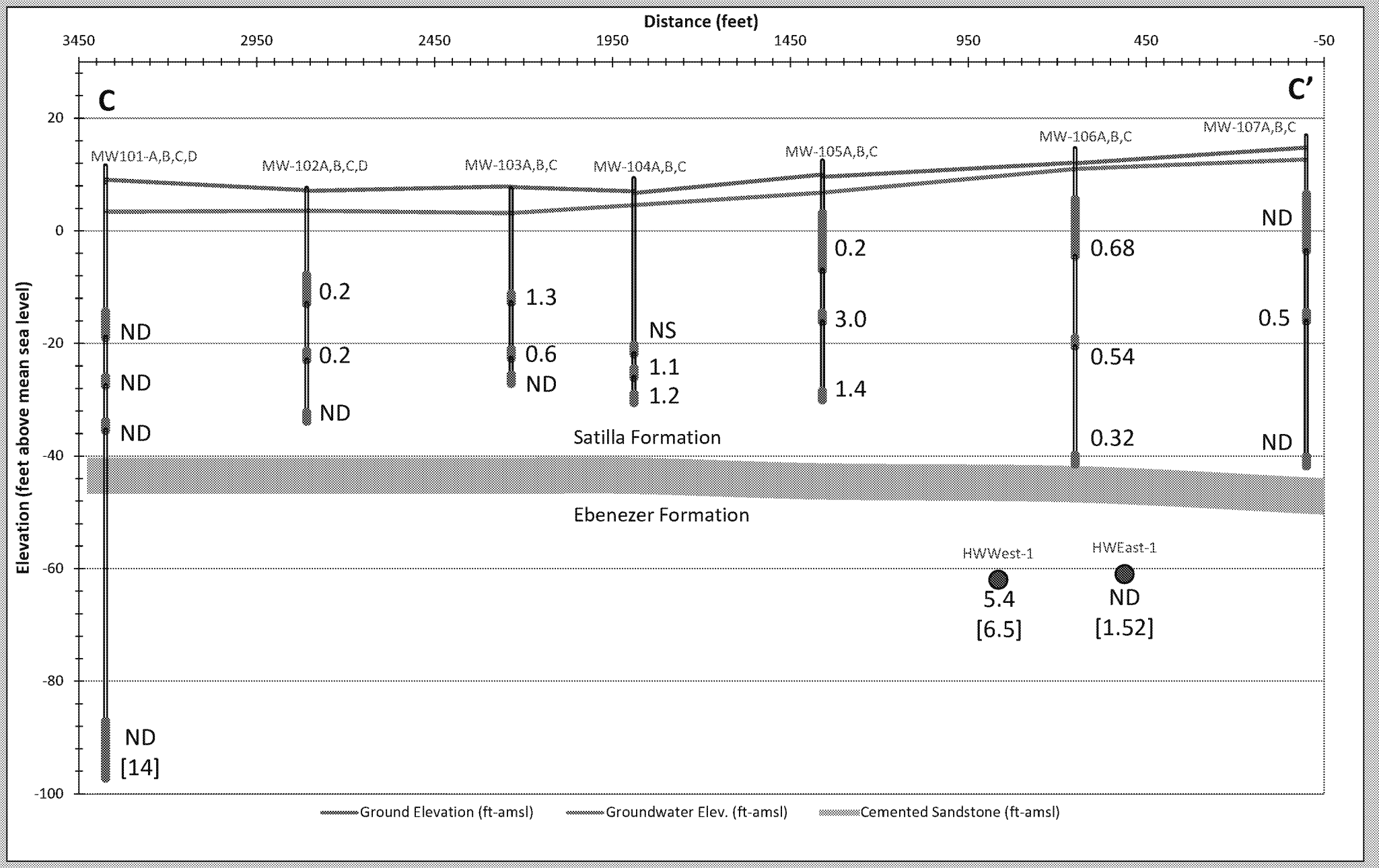
<u>Naphthalene</u>

- Concentration > RSL from MW-104 to MW-106 series



Transect C-C'

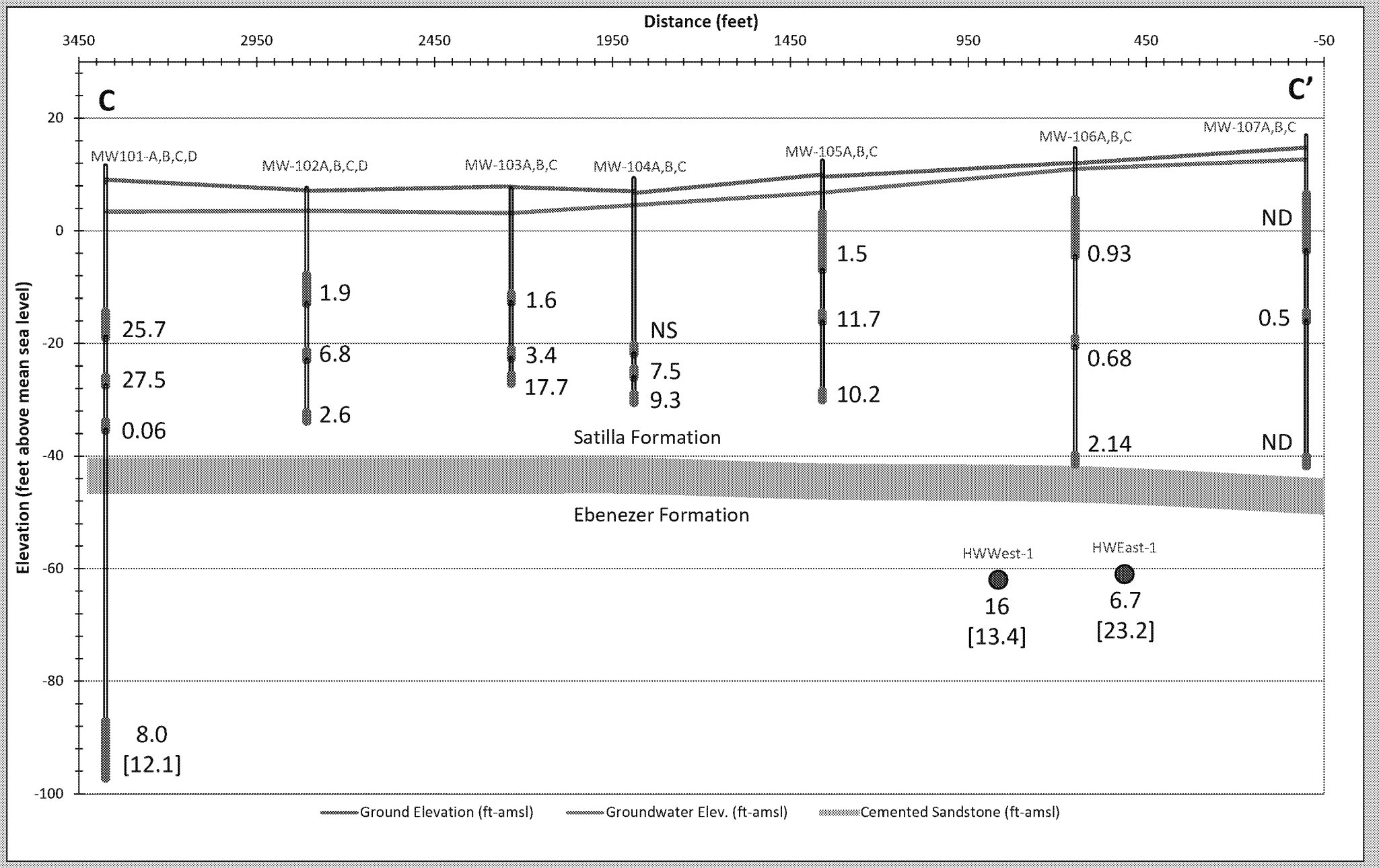
2017 Arsenic MCL: 10 µg/L



[2019 Testing Result]

Transect C-C'

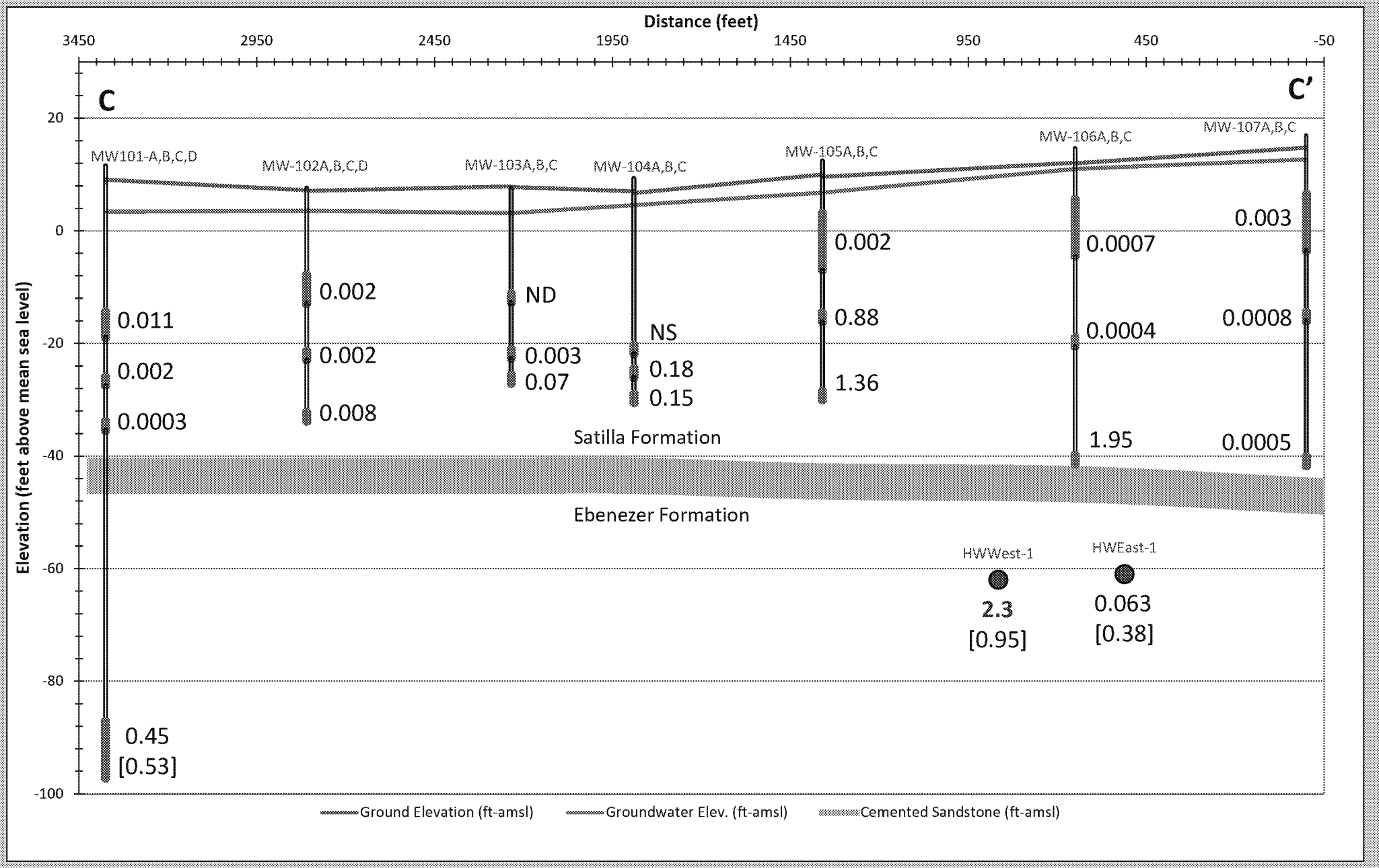
2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]

Transect C-C'

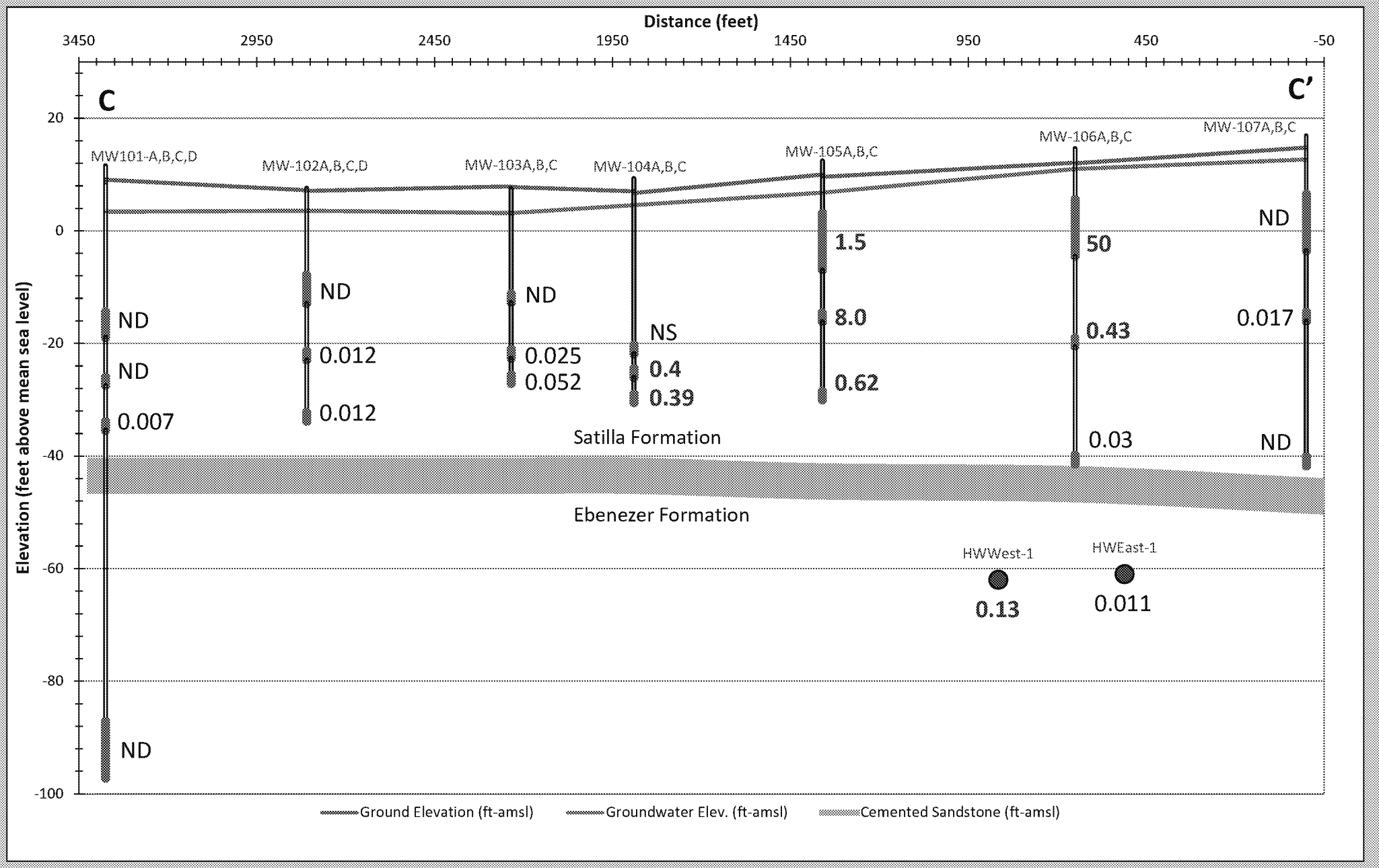
2017 Mercury MCL: 2 µg/L



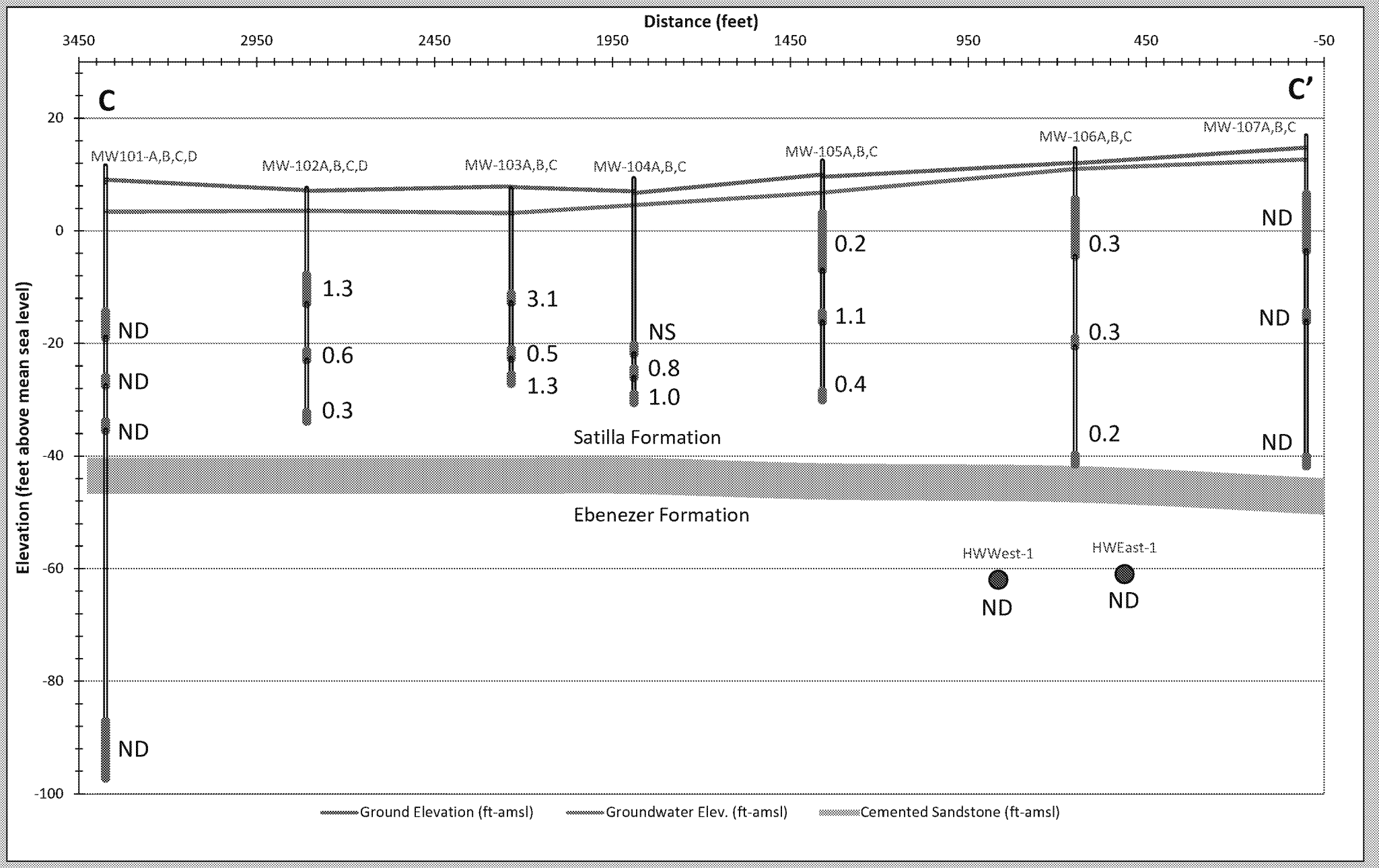
[2019 Testing Result]

Transect C-C’

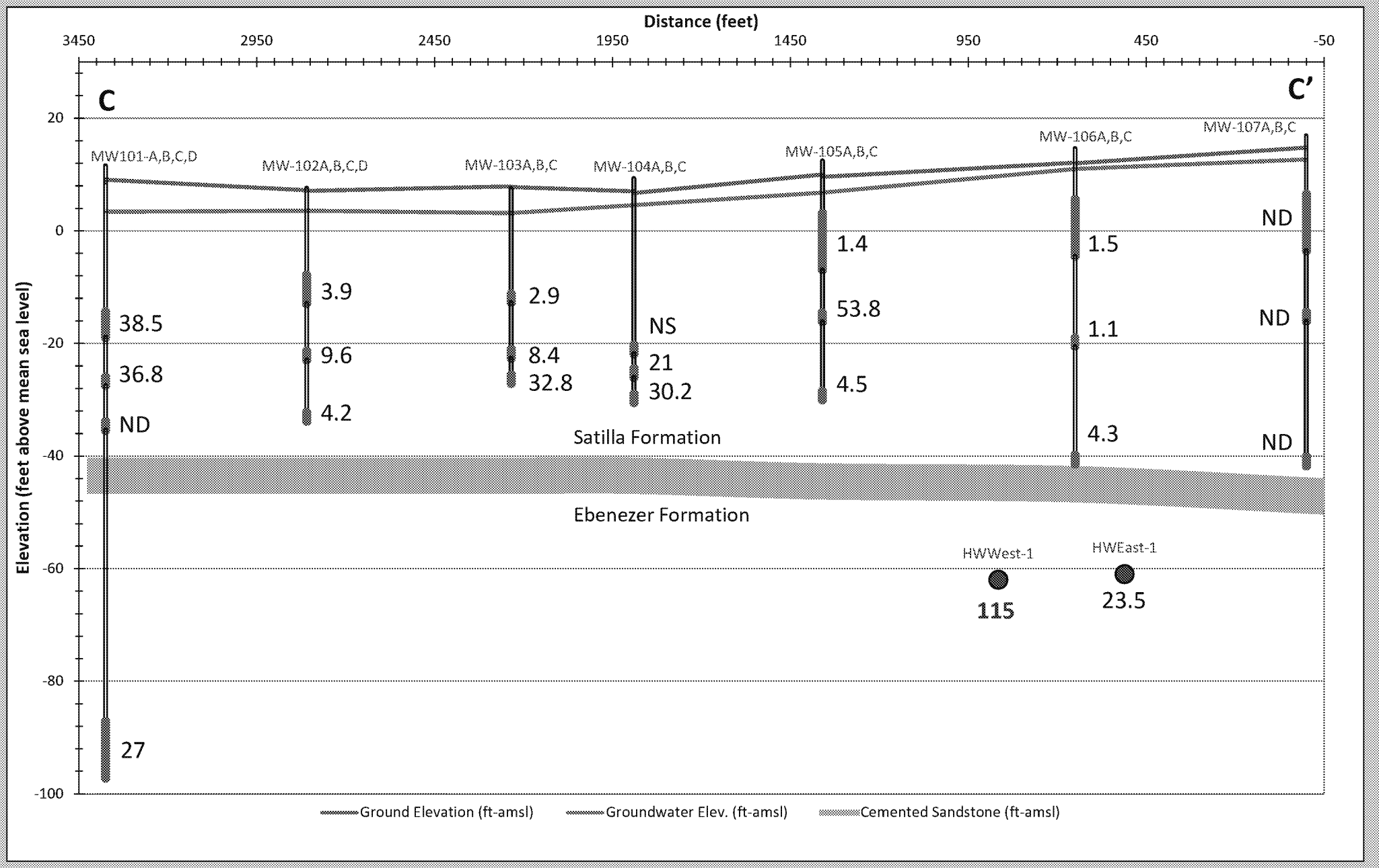
2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



Transect C-C’
2017 Selenium MCL: 50 µg/L



Transect C-C’
2017 Vanadium RSL: 86 µg/L



Transect D-D'

MW-351A,B
MW-352A,B,C,D
MW-504A,B
MW-510A,B
MW-353A,B
MW-509A,B
MW-506A,B
MW-354A,B
MW-312A,B
HWEast2
HWWest2

<u>As & Cr</u>

- >MCL near CBA and marsh well (deep)

<u>Hg & Naphthalene</u>

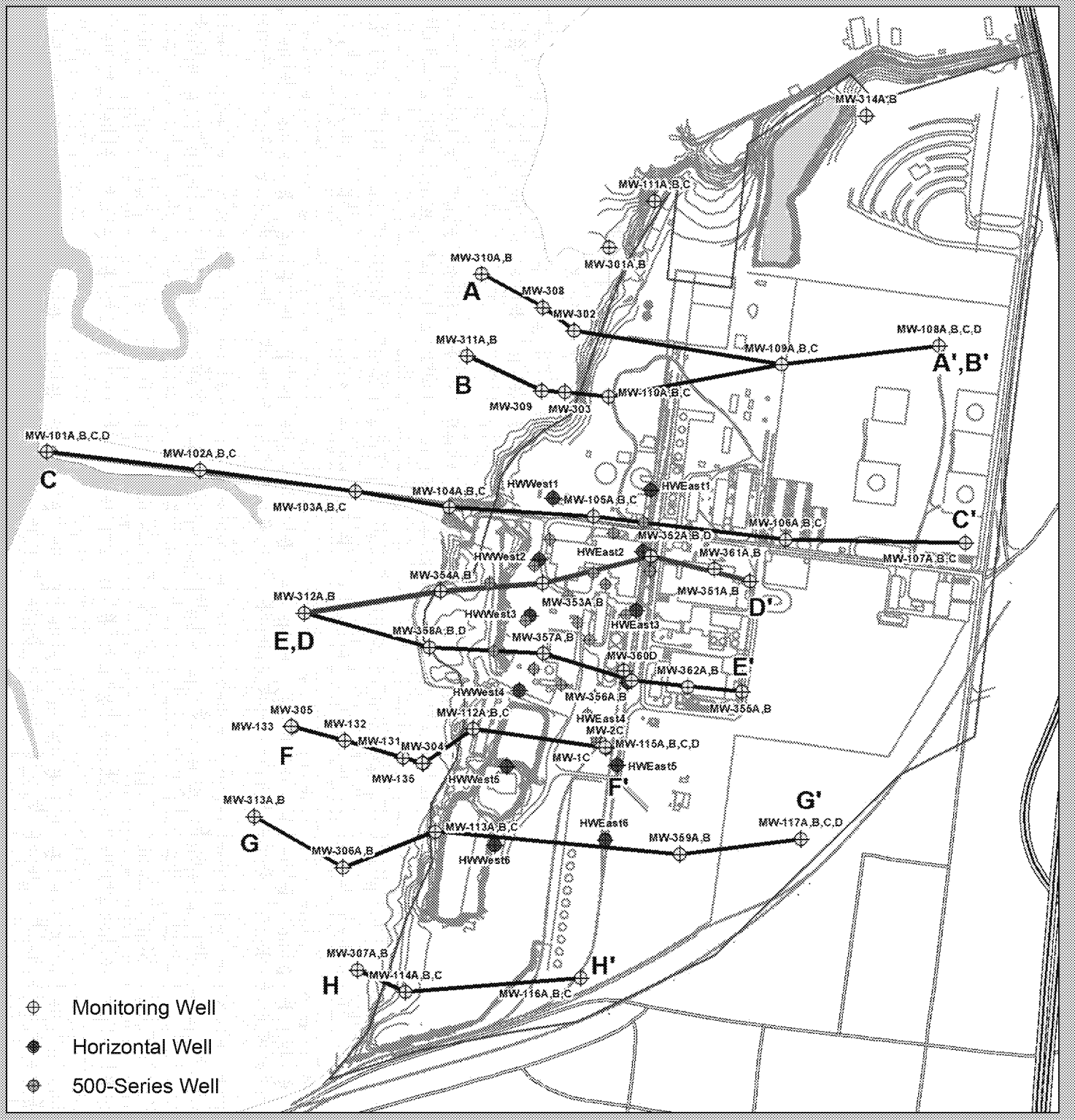
- >MCL/RSL near CBA
- Improves in marsh wells
- Highest Hg concentration in Ebenezer

<u>Se</u>

- No issues
- No compelling gradient

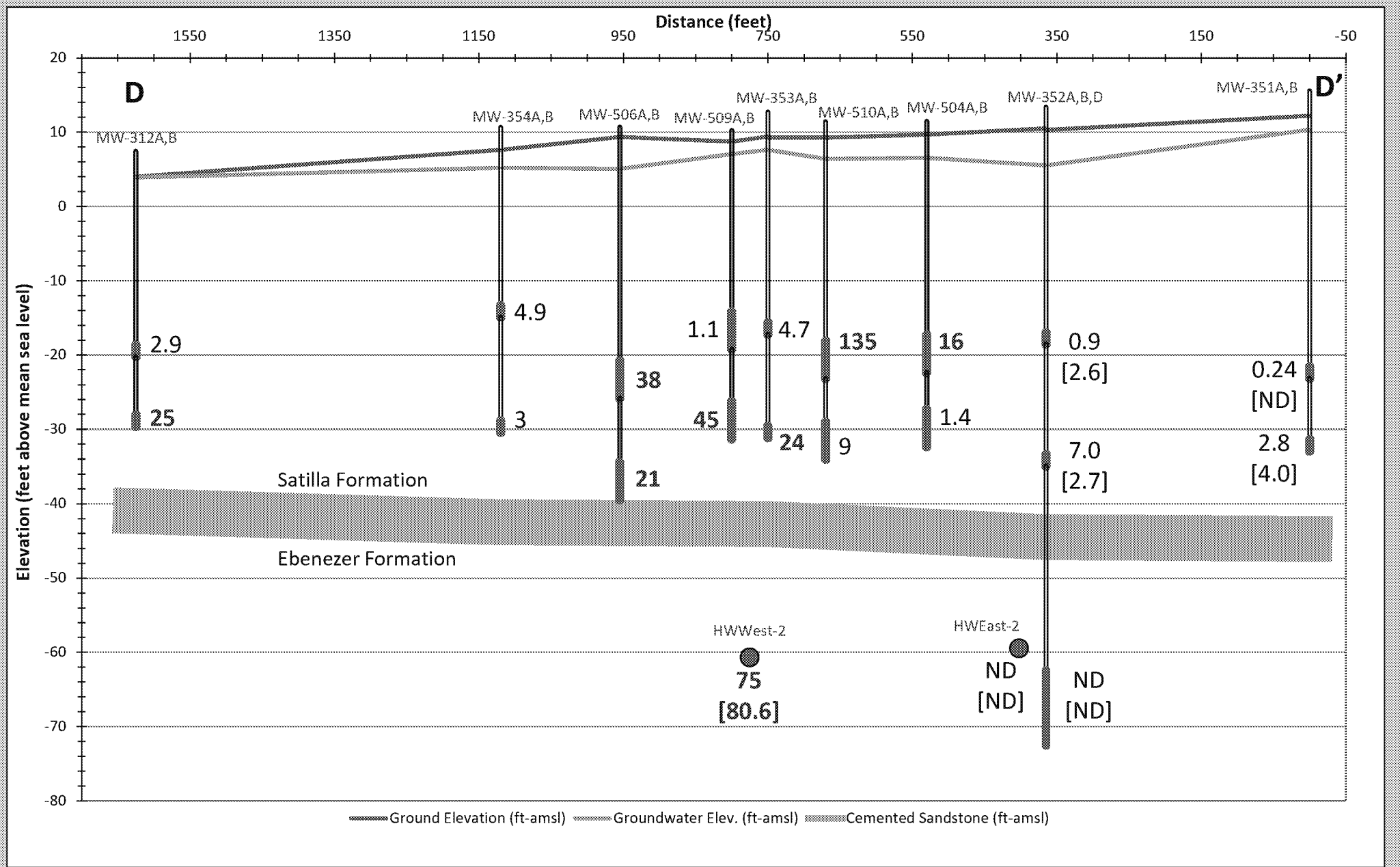
<u>V</u>

- >>MCL in CBA and western most marsh well



Transect D-D’

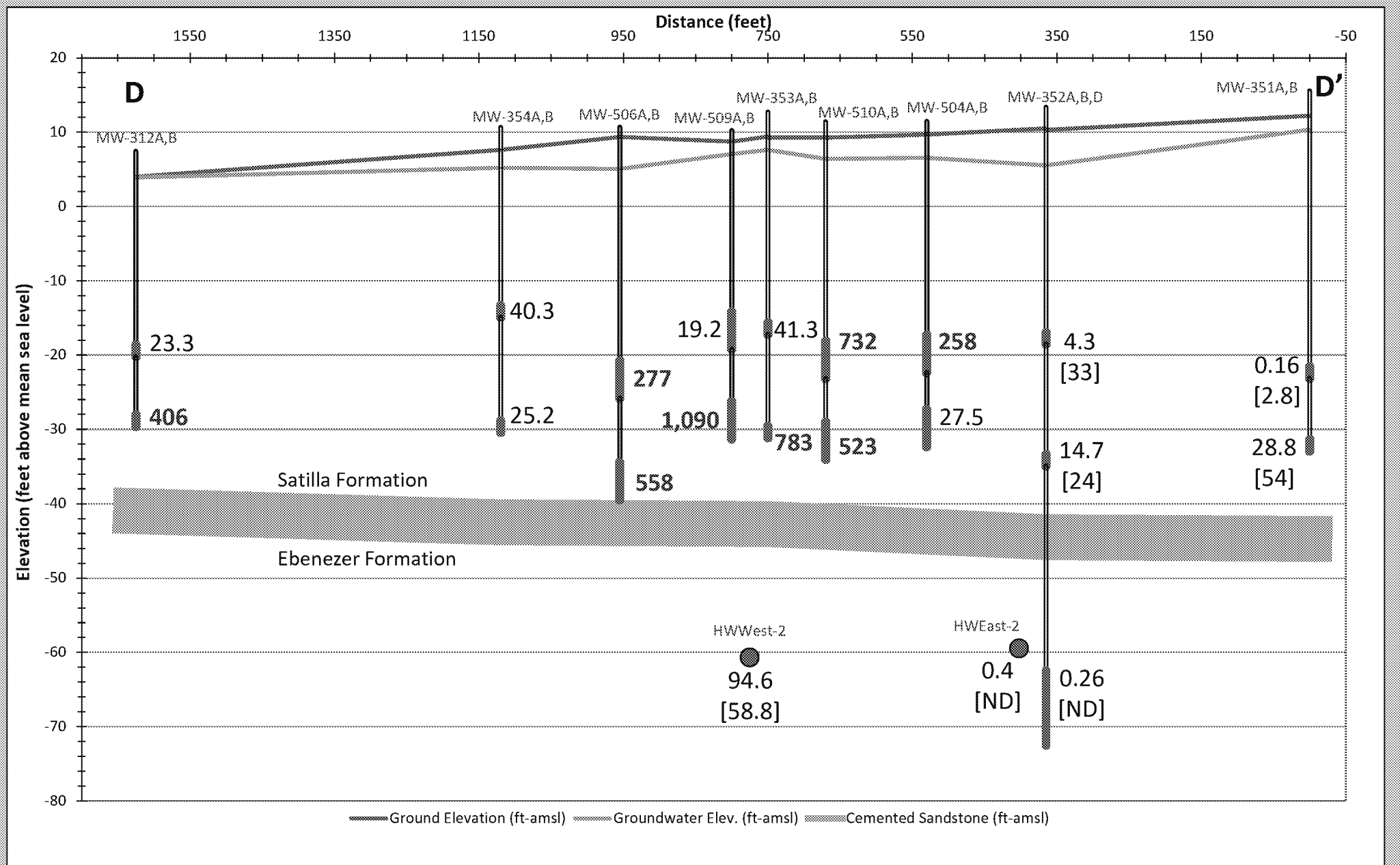
2017 Arsenic MCL: 10 µg/L



[2019 Testing Result]

Adjacent HW and 500 series wells are projected on the transect

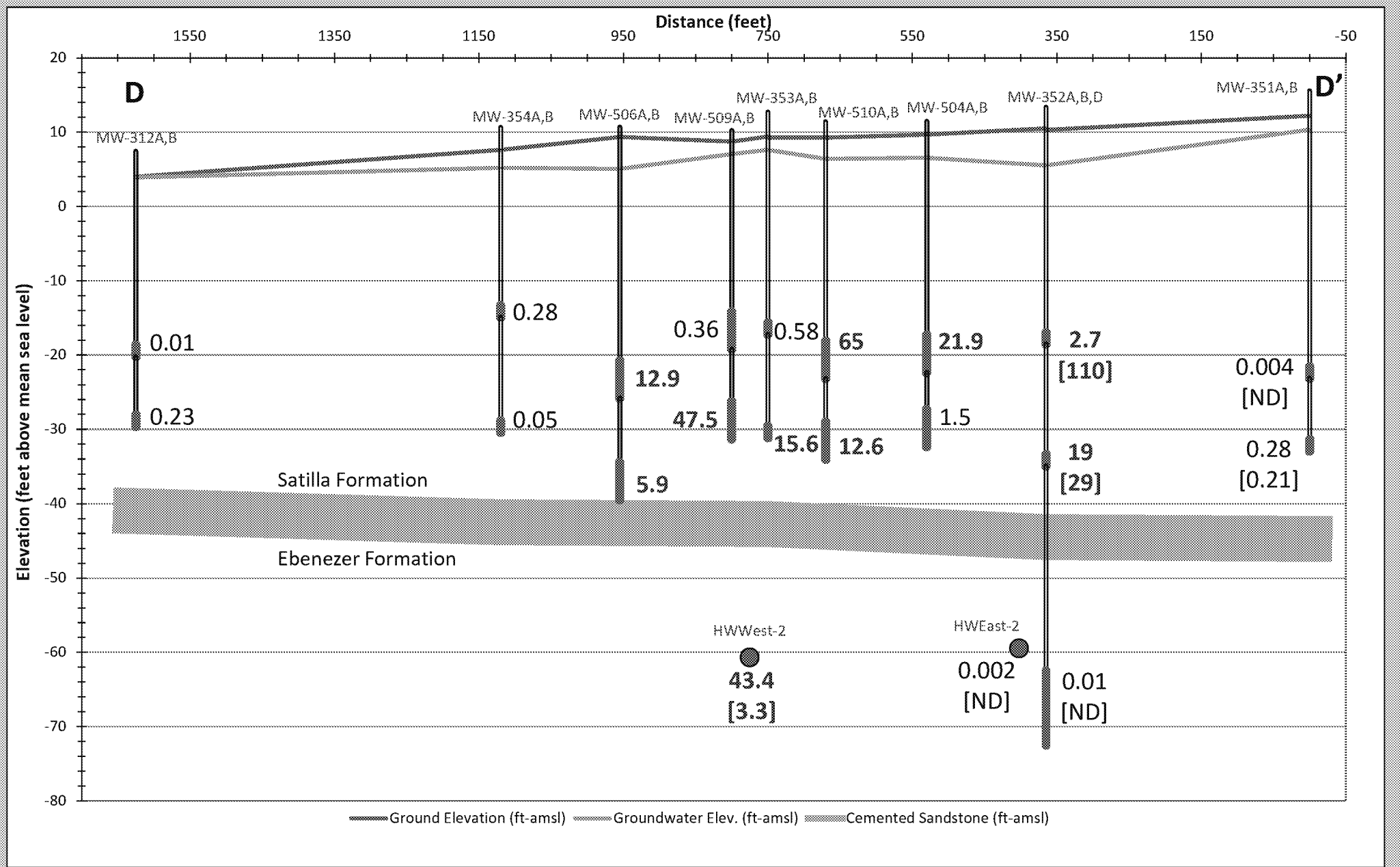
Transect D-D’
2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]
Adjacent HW and 500 series wells are projected on the transect

Transect D-D’

2017 Mercury MCL: 2 µg/L

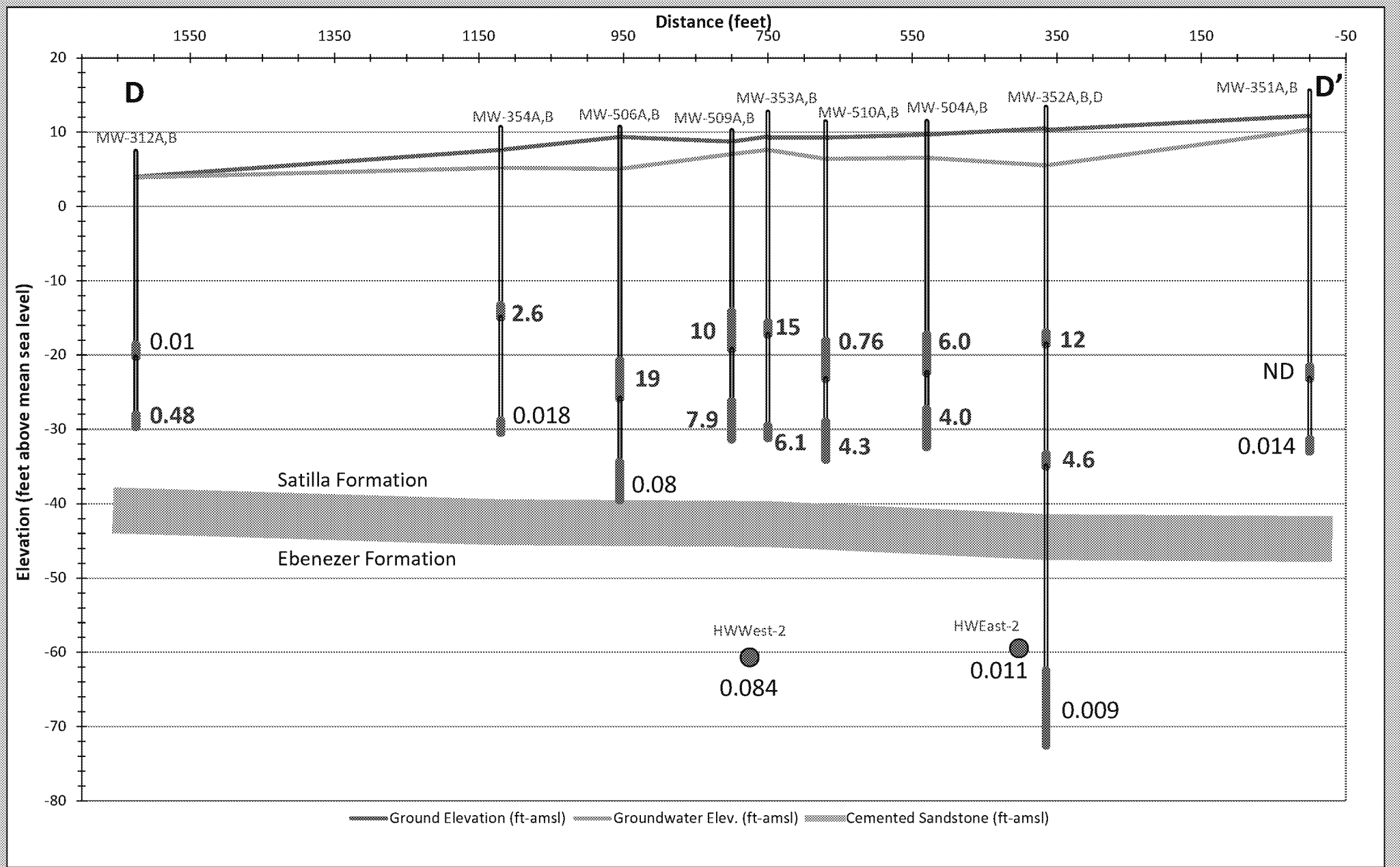


[2019 Testing Result]

Adjacent HW and 500 series wells are projected on the transect

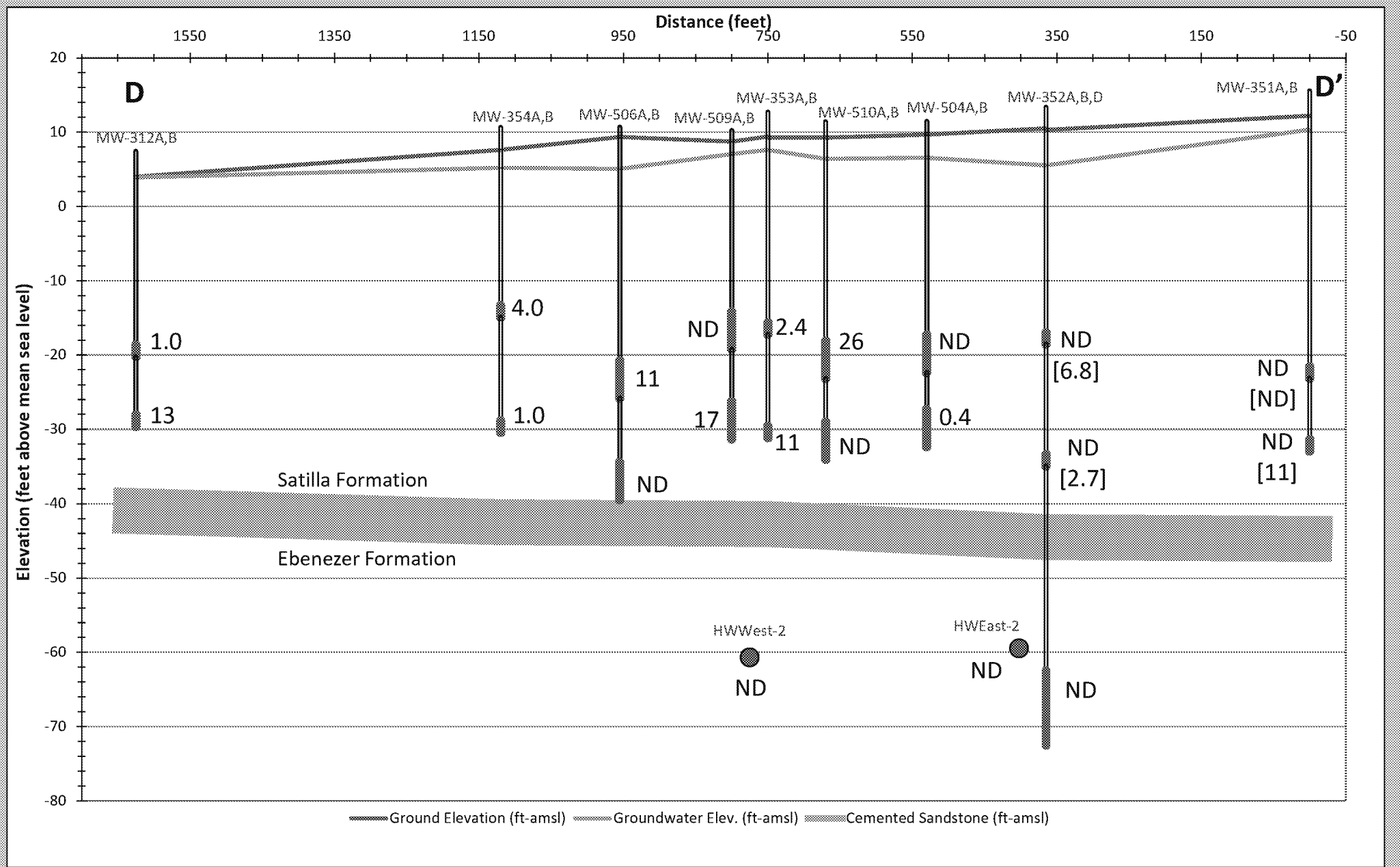
Transect D-D’

2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



Adjacent HW and 500 series wells are projected on the transect

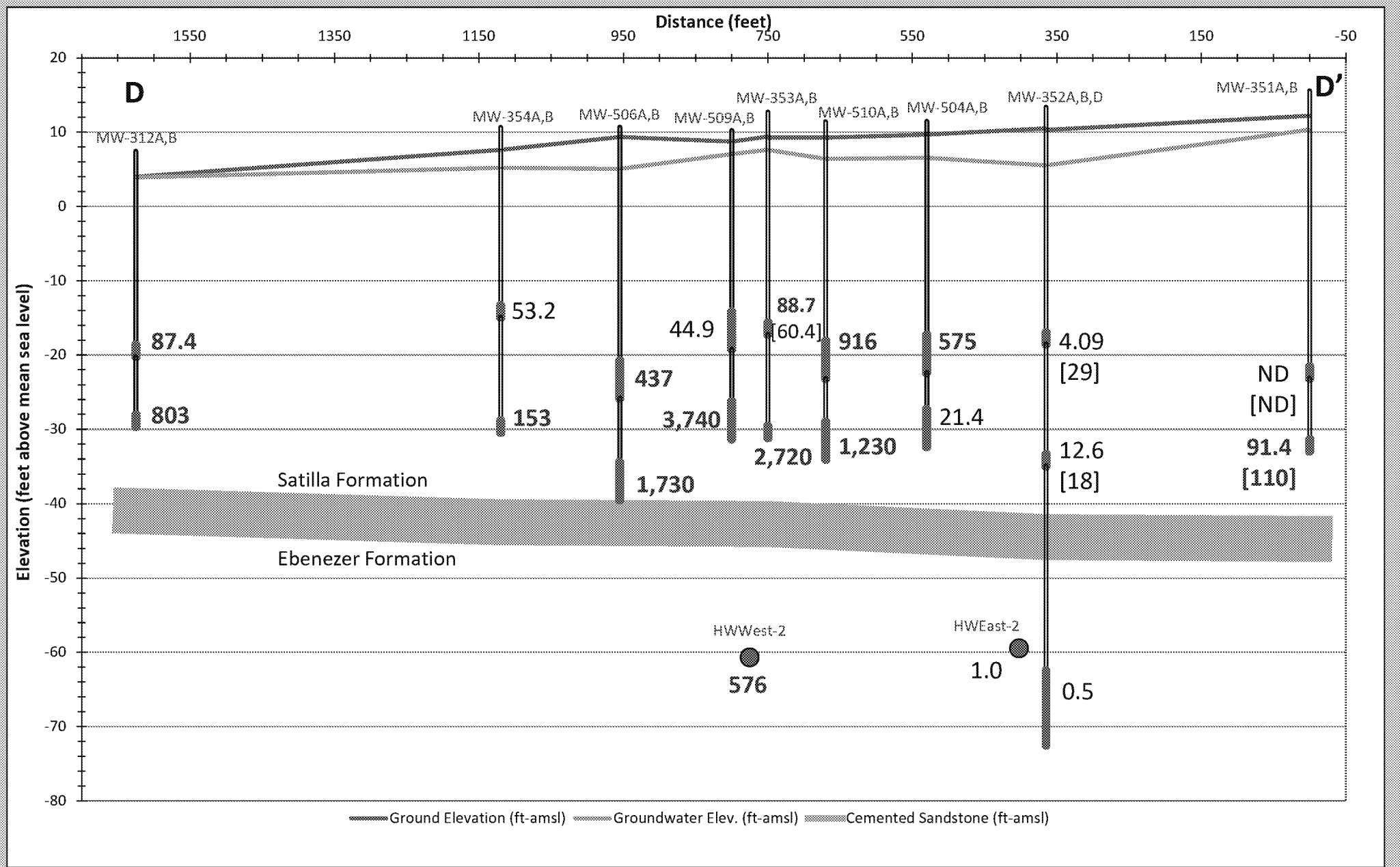
Transect D-D’
2017 Selenium MCL: 50 µg/L



[2019 Testing Result]
Adjacent HW and 500 series wells are projected on the transect

Transect D-D’

2017 Vanadium RSL: 86 µg/L



[2019 Testing Result]

Adjacent HW and 500 series wells are projected on the transect

Transect E-E'

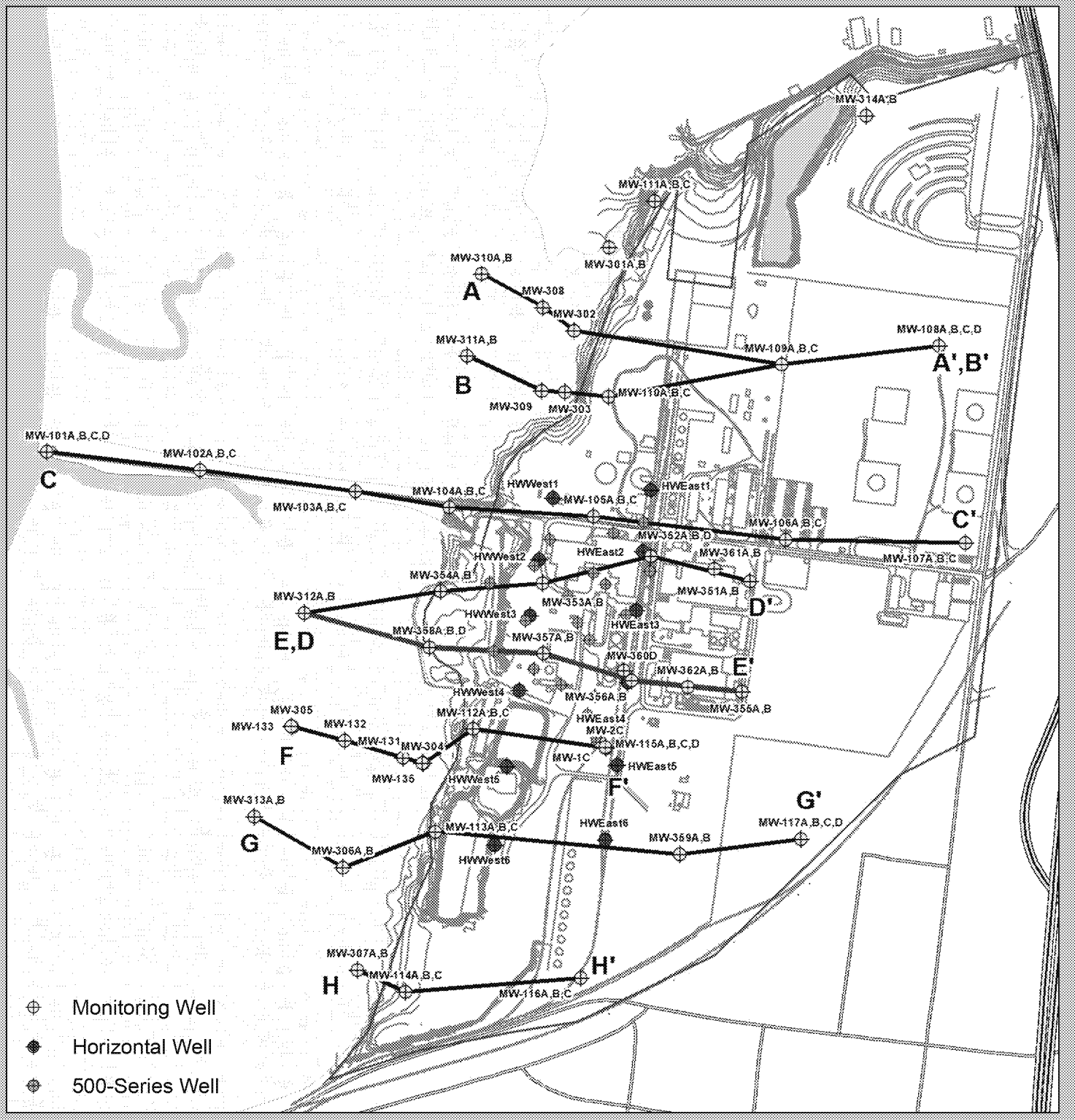
MW-355A,B
MW-356A,B
MW-516A,B
MW-357A,B
MW-518A,B
MW-507A,B
MW-358A,B,D
MW-312A,B
HWEast4
HWWest3

<u>As</u>
- >MCL CBA and marsh well
- Highest detection in Ebenezer

<u>Hg & Naphthalene</u>
- >MCL/RSL near CBA
- Improves in marsh well

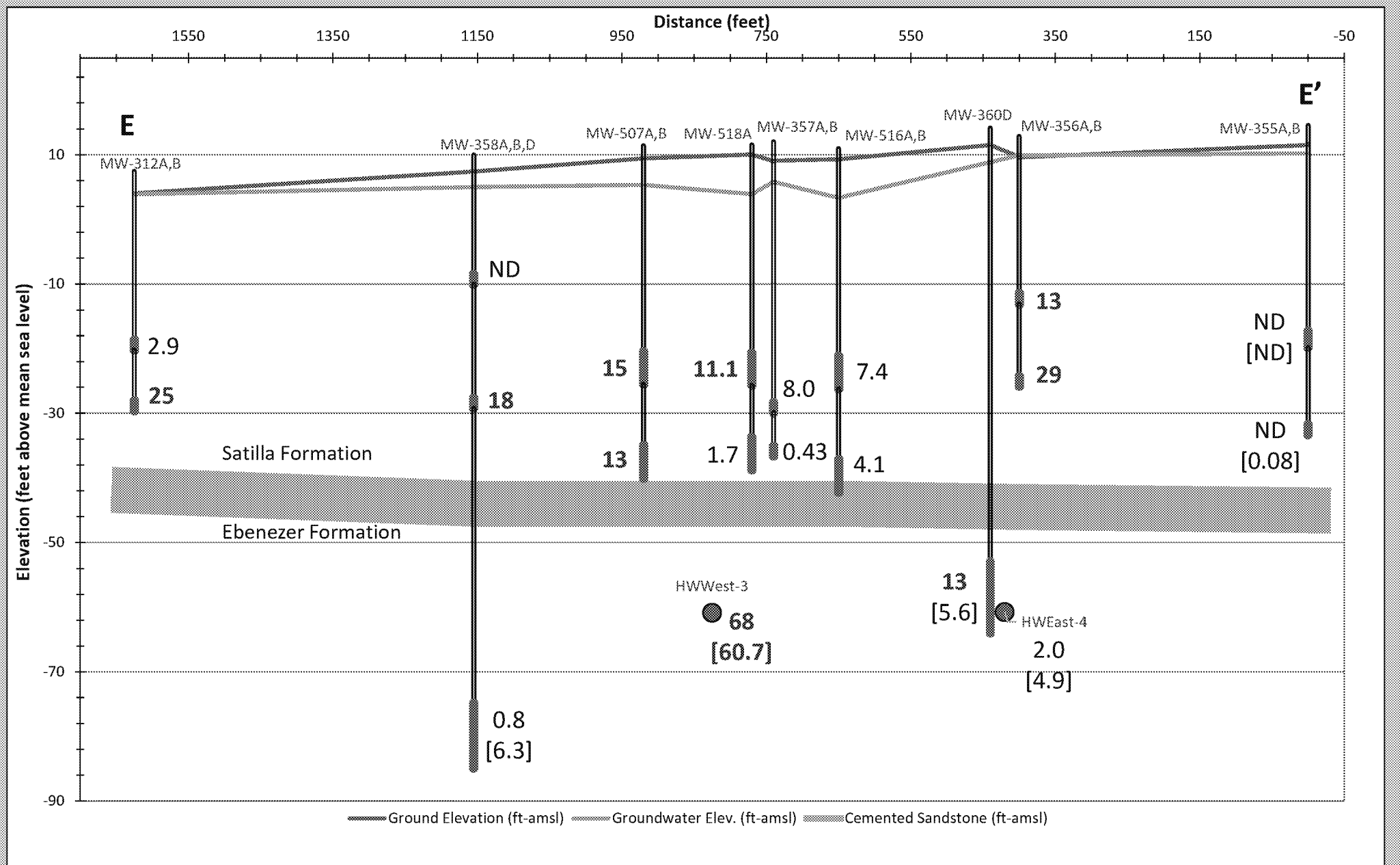
<u>Se</u>
- No issues
- No compelling gradient

<u>Cr & V</u>
- >MCL in CBA with increasing gradient in marsh boundary/marsh well
- V elevated in Ebenezer



Transect E-E'

2017 Arsenic MCL: 10 µg/L

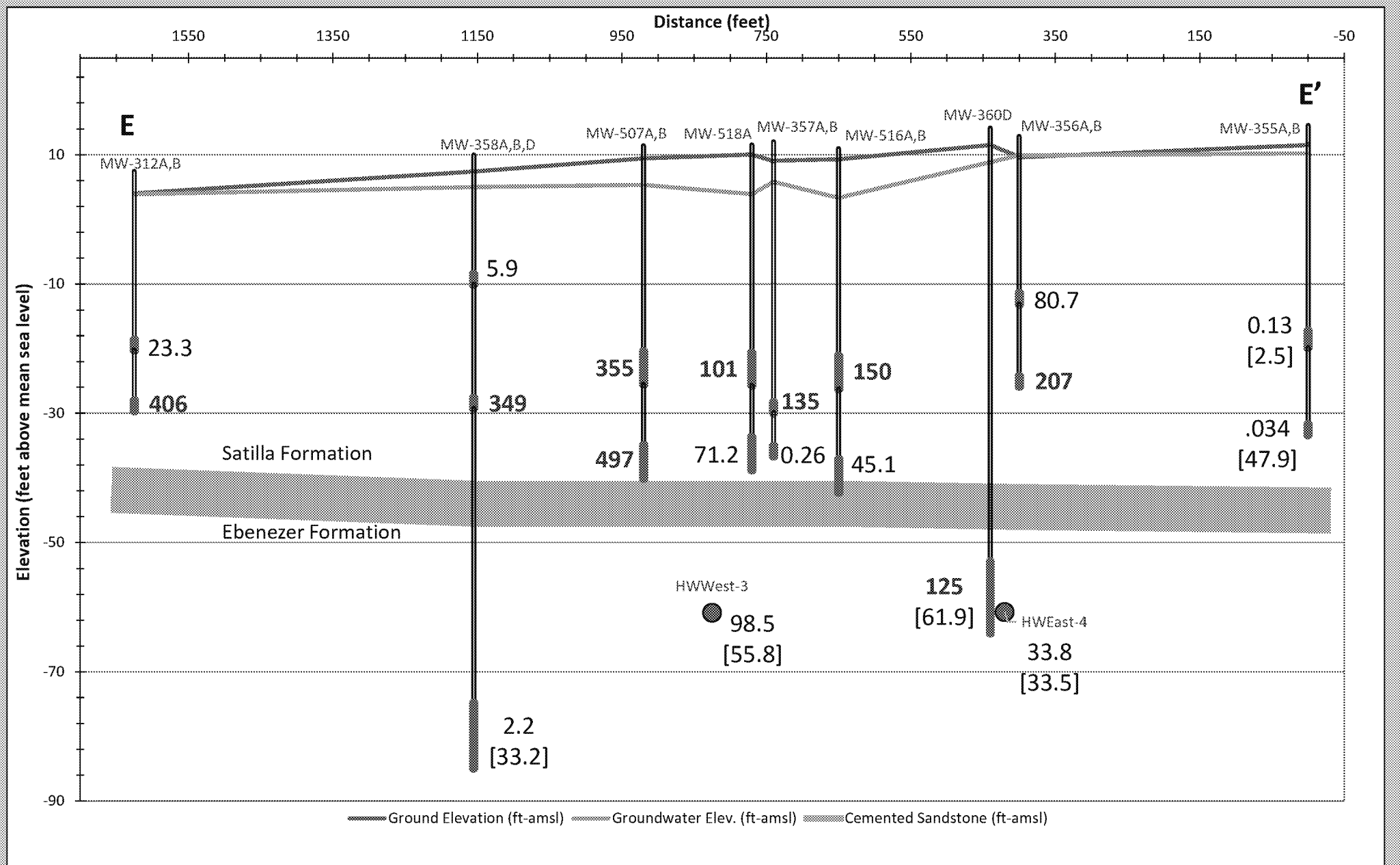


[2019 Testing Result]

Adjacent HW and 500 series wells are projected on the transect

Transect E-E’

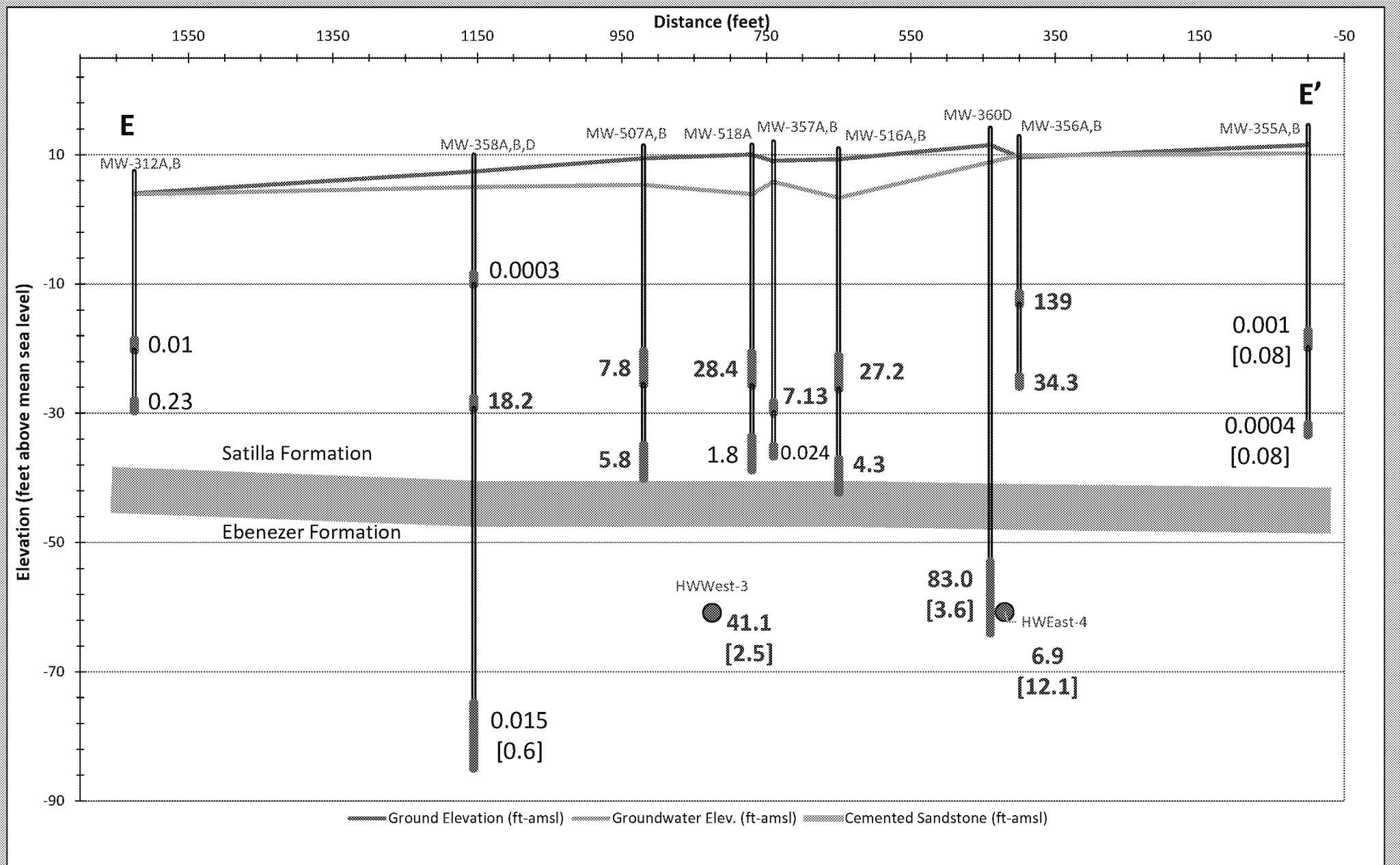
2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]

Adjacent HW and 500 series wells are projected on the transect

Transect E-E'
2017 Mercury MCL: 2 µg/L

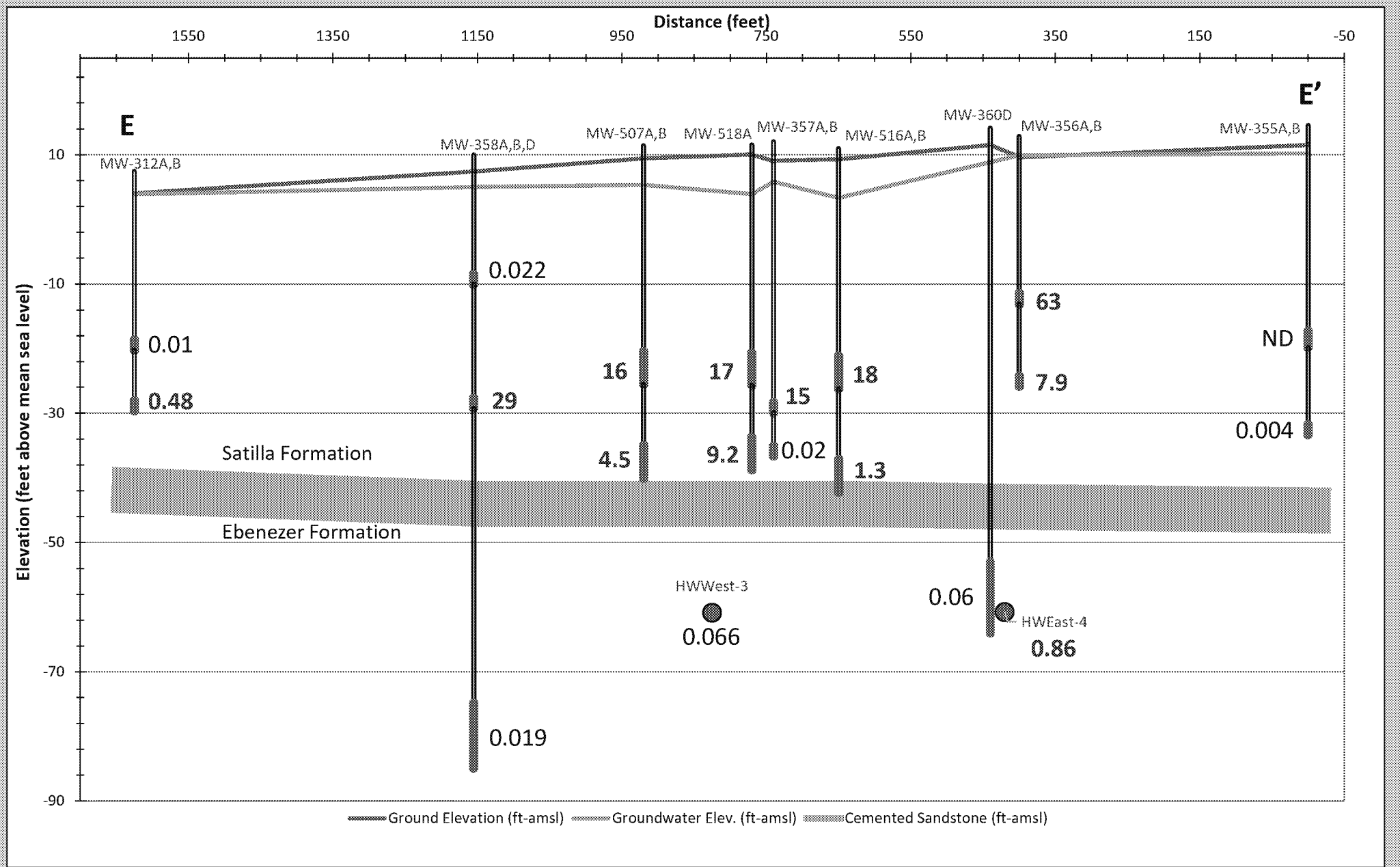


[2019 Testing Result]

Adjacent HW and 500 series wells are projected on the transect

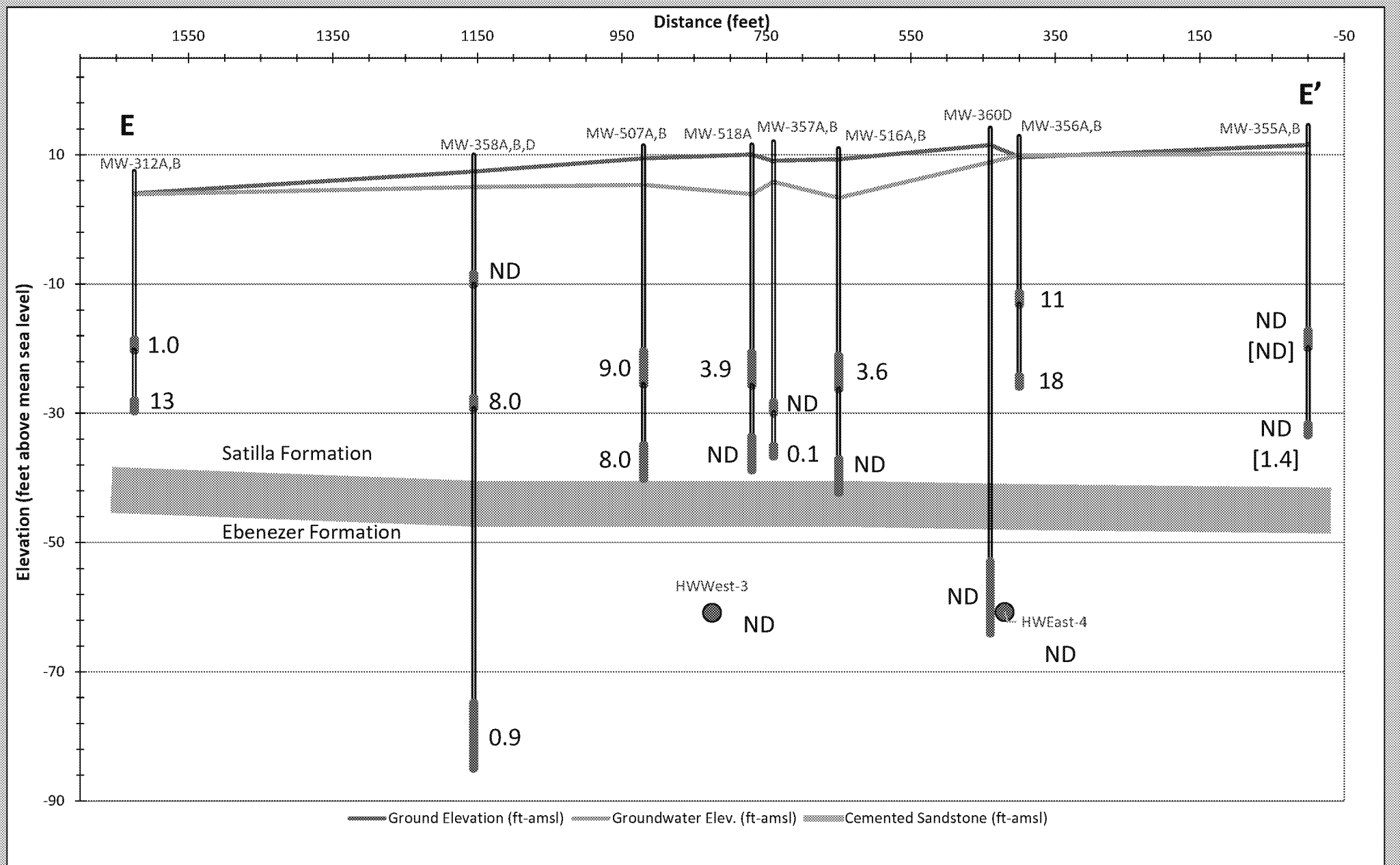
Transect E-E’

2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



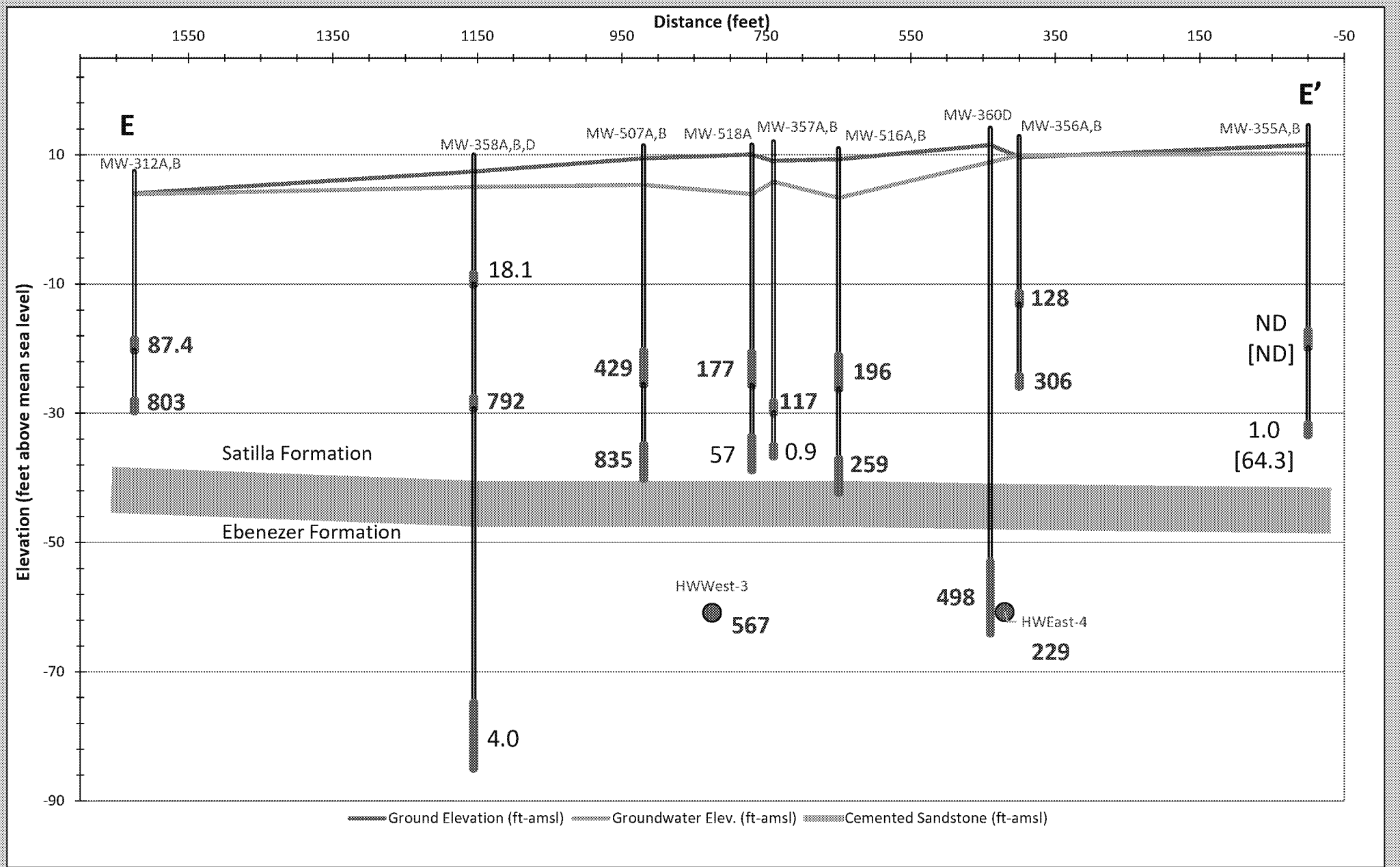
Adjacent HW and 500 series wells are projected on the transect

Transect E-E’
2017 Selenium MCL: 50 µg/L



[2019 Testing Result]
Adjacent HW and 500 series wells are projected on the transect

Transect E-E’
2017 Vanadium RSL: 86 µg/L



[2019 Testing Result]
Adjacent HW and 500 series wells are projected on the transect

Transect F-F'

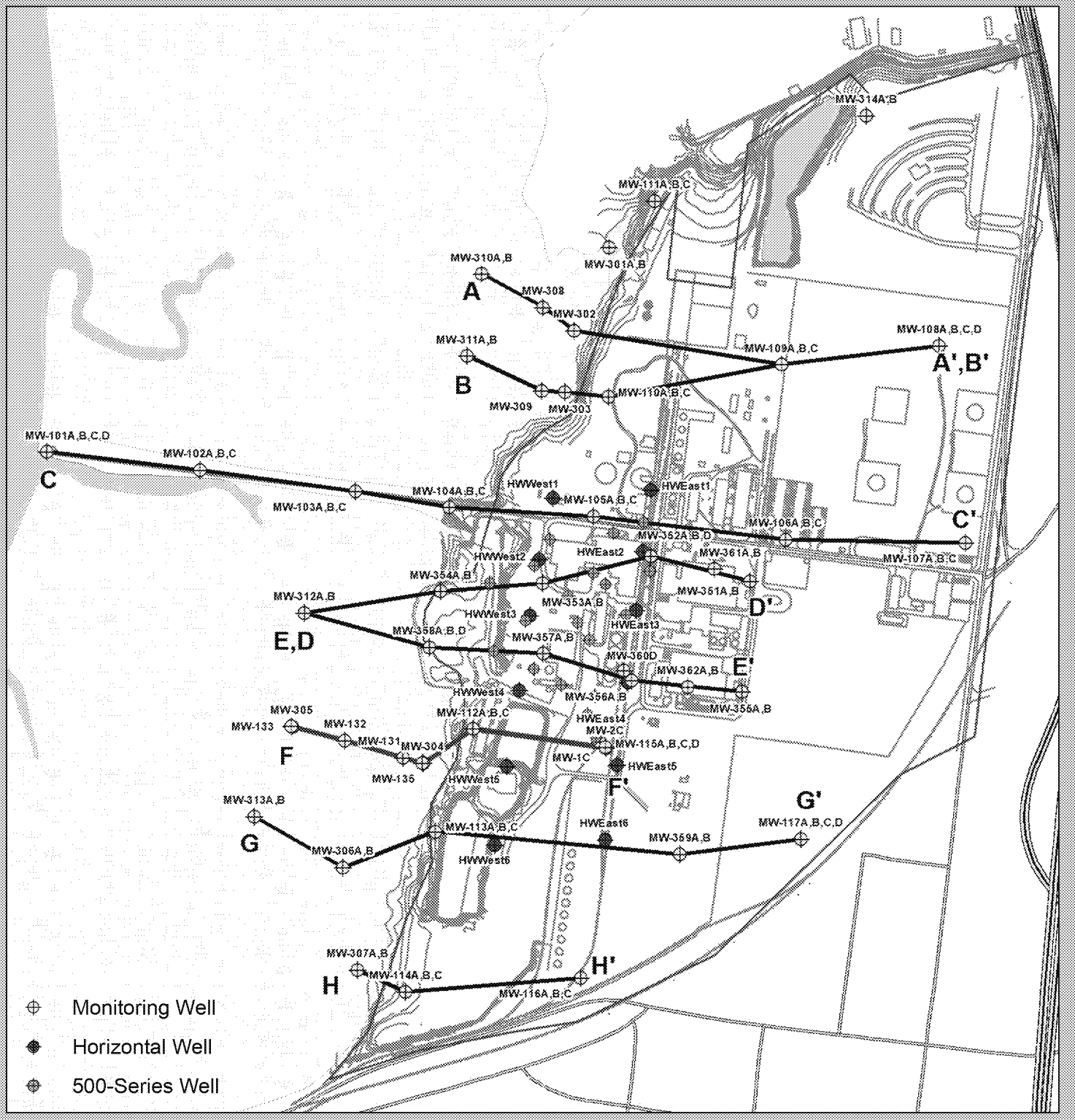
MW-115A,B,C,D
MW-112A,B,C
MW-304
MW-135
MW-131
MW-132
MW-305
MW-133
HWWest5
HWEast5

<u>As, Cr & V</u>
- highest near marsh boundary
- >MCL or near MCL across transect

<u>Hg</u>
- Common 1-10x MCL
- Improves in marsh

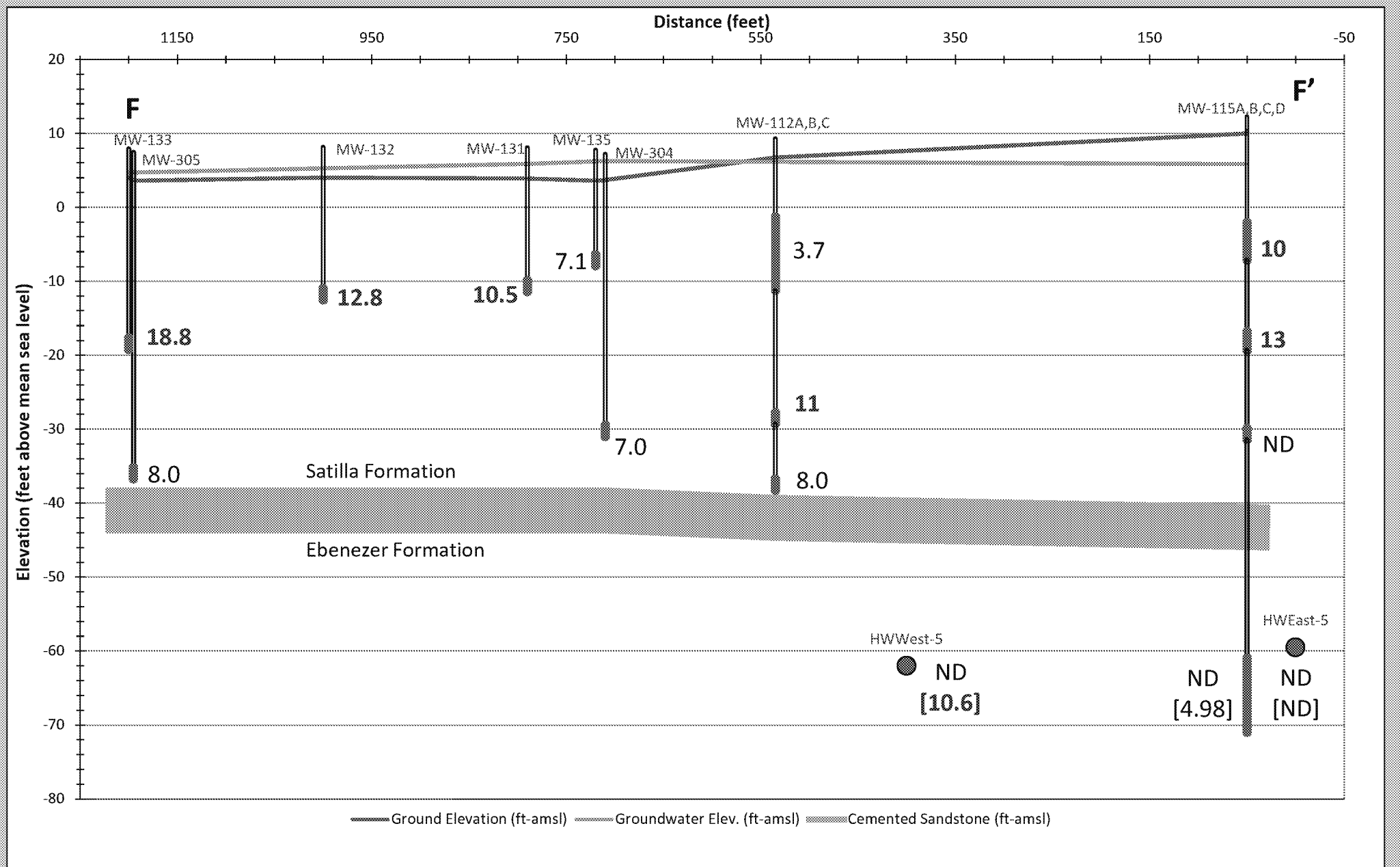
<u>Se</u>
- No issue in 2017

<u>Naphthalene</u>
- >RSL across transect
- Highest concentrations in marsh wells



Transect F-F'

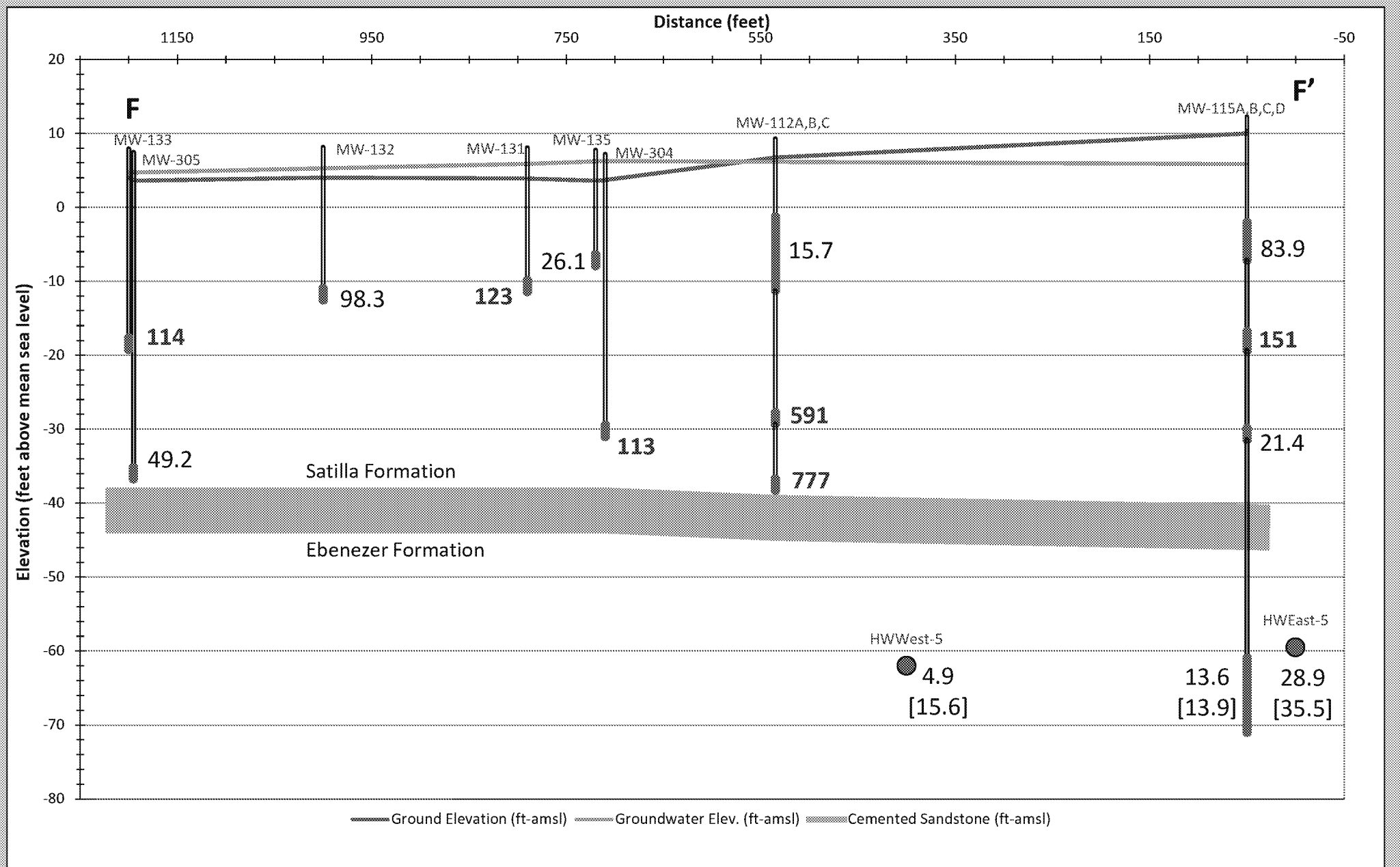
2017 Arsenic MCL: 10 µg/L



[2019 Testing Result]

Transect F-F'

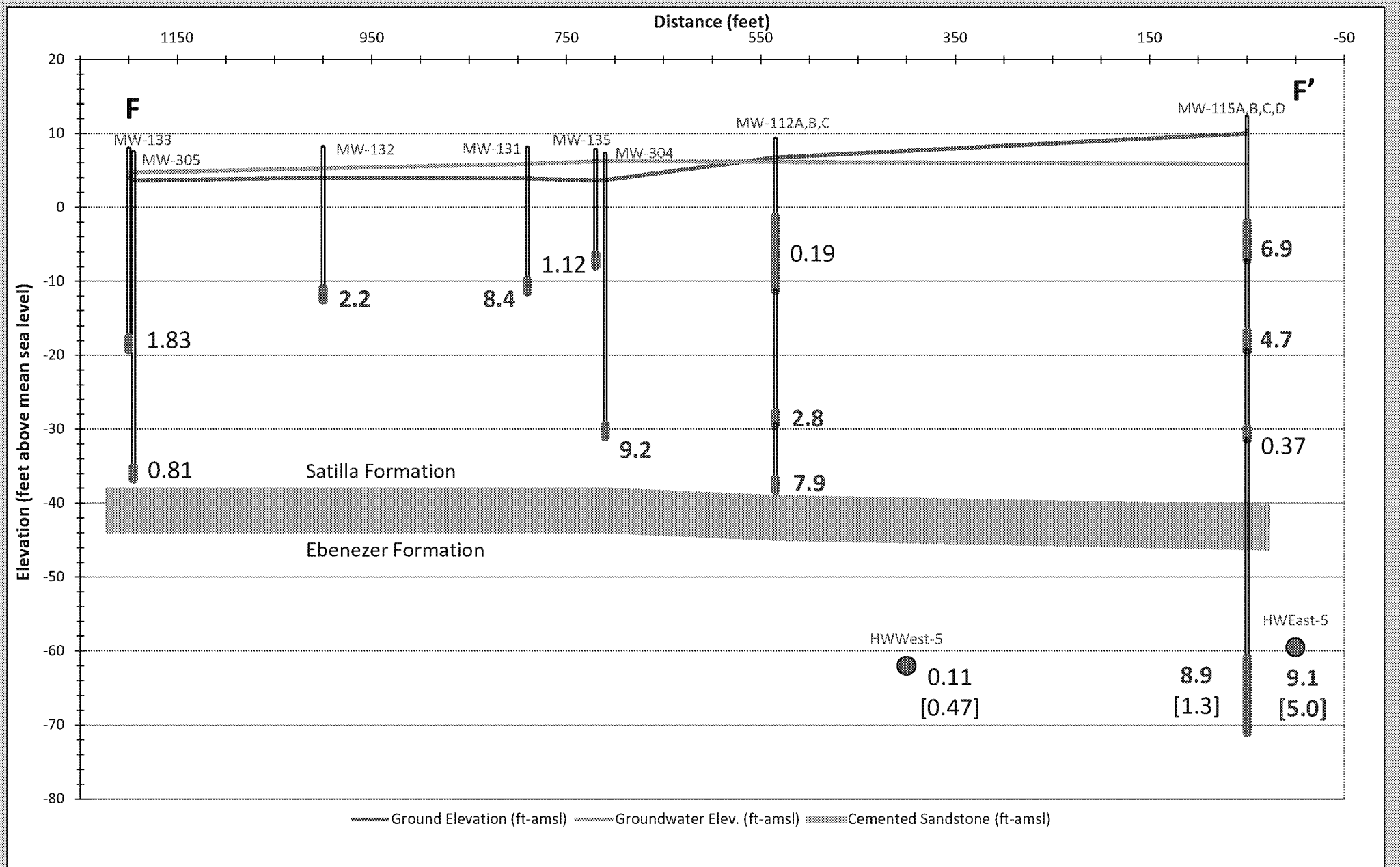
2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]

Transect F-F'

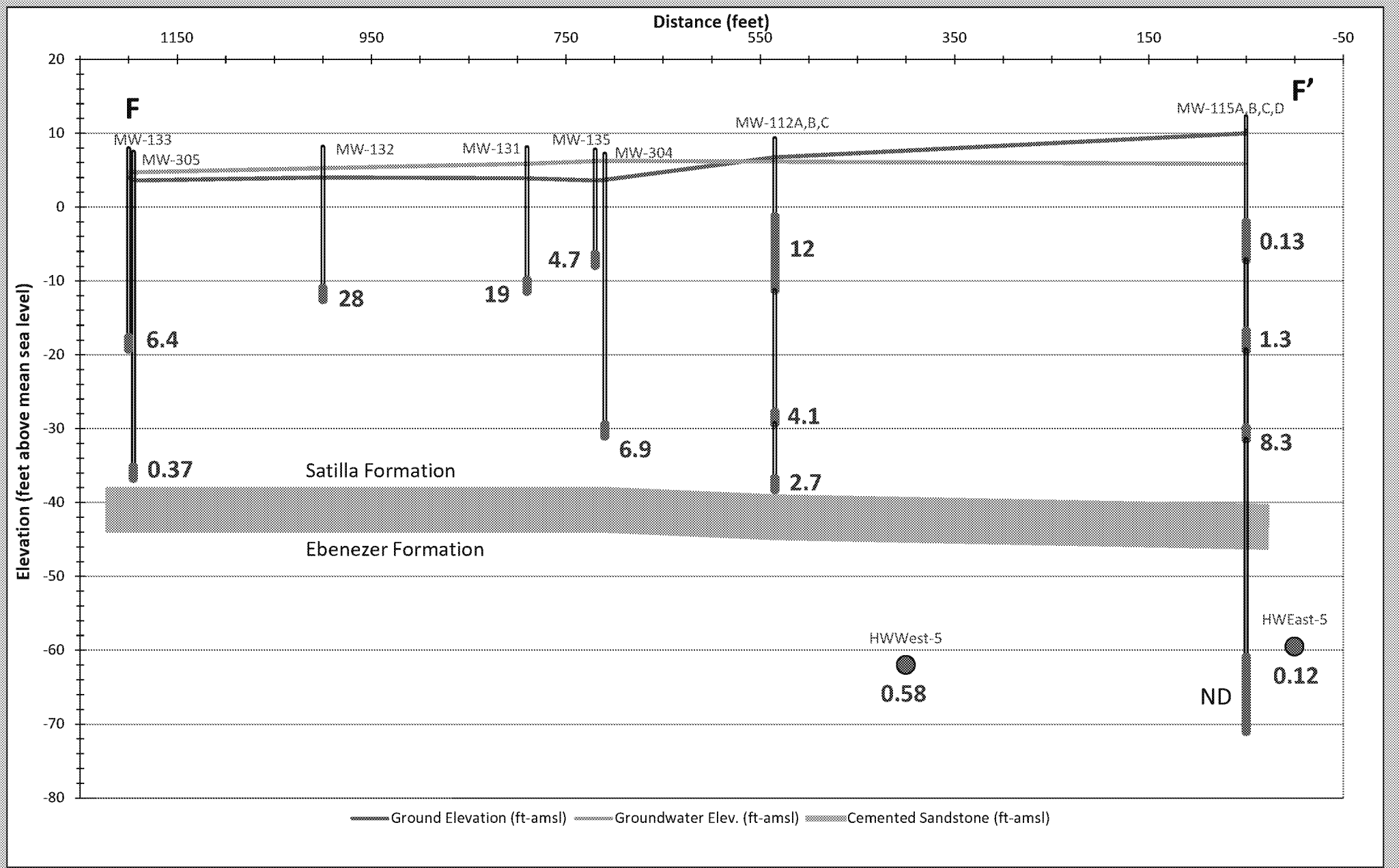
2017 Mercury MCL: 2 µg/L



[2019 Testing Result]

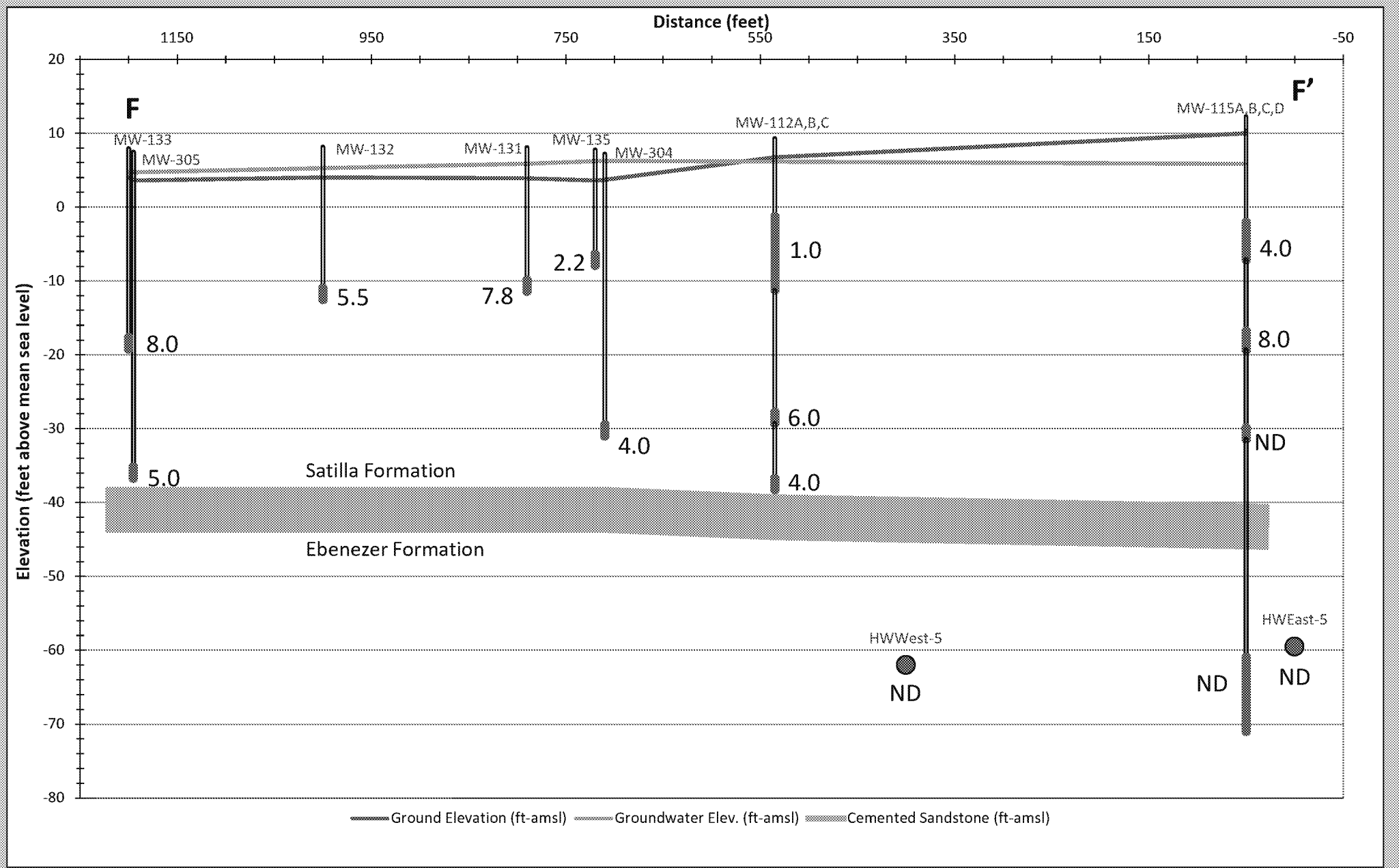
Transect F-F'

2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



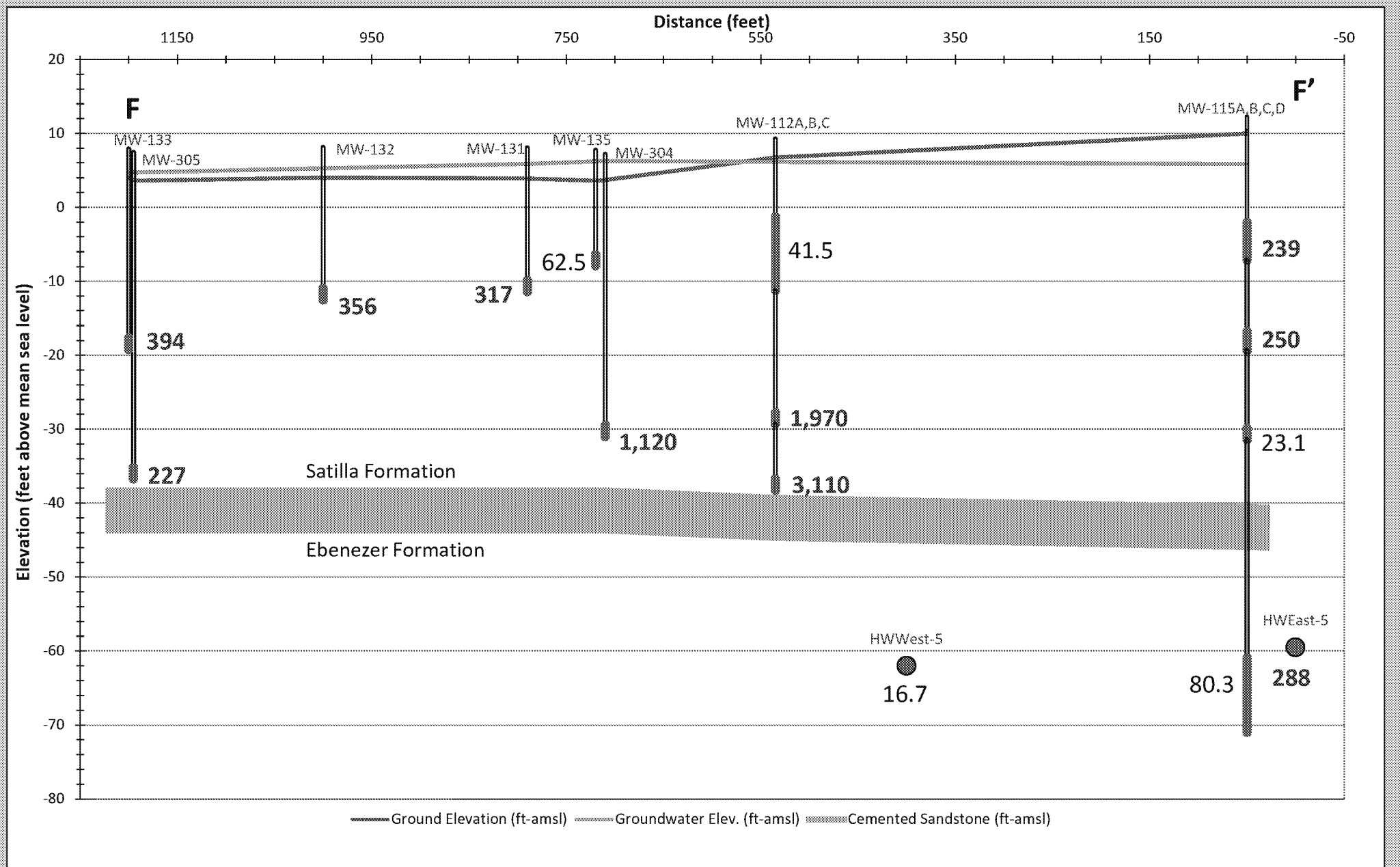
Transect F-F'

2017 Selenium MCL: 50 µg/L



Transect F-F'

2017 Vanadium RSL: 86 µg/L



Transect G-G'

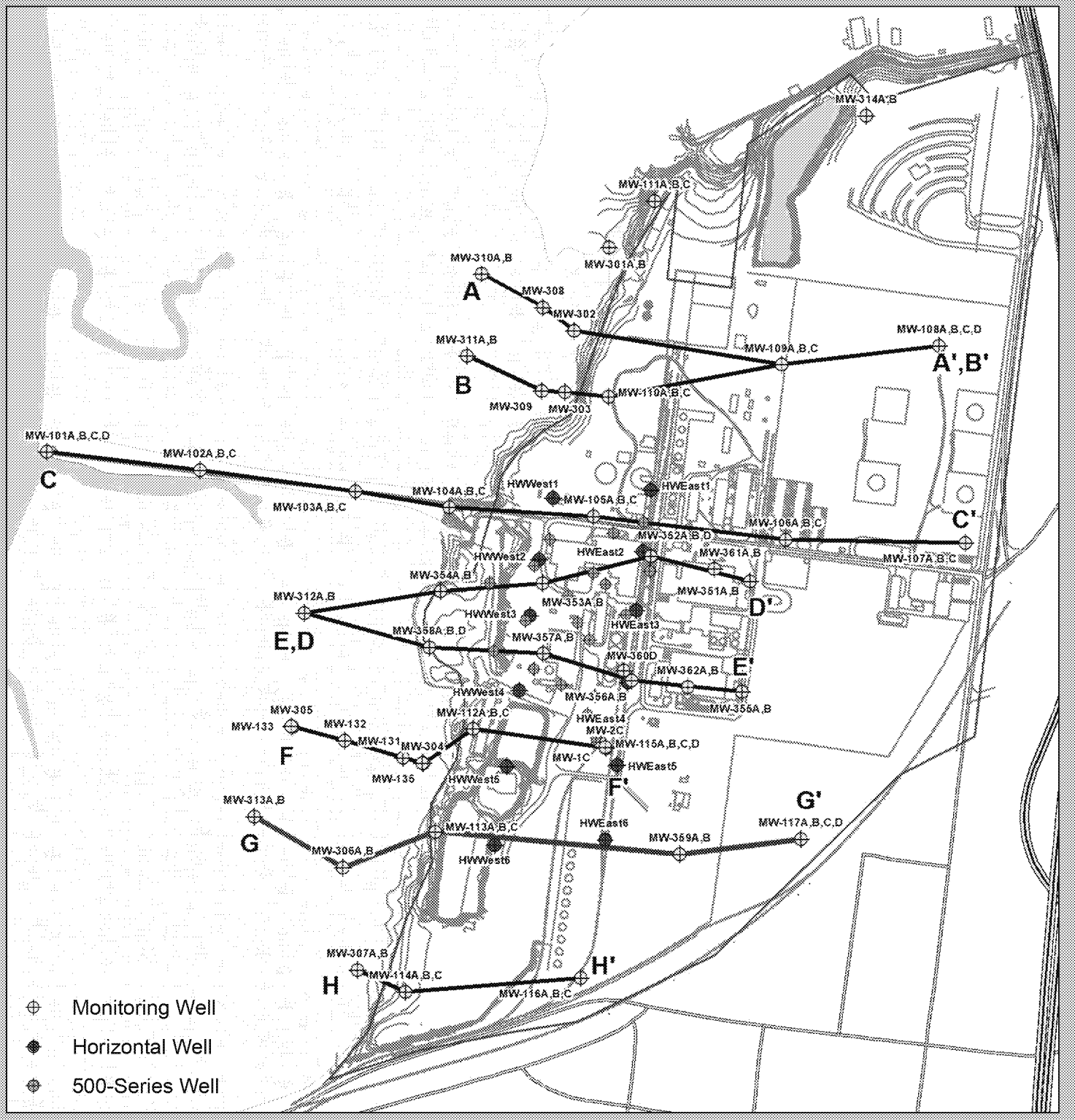
MW-117A,B,CD
MW-359A,B
MW-113A,B,C
MW-306B
MW-313A,B
HWEast6
HWWest6

<u>As & Cr</u>
- 1-3x MCL occurrences
- Highest concentration is western most well

<u>Hg</u>
- In general, near or less than MCL, but
- 25x MCL near marsh-upland boundary

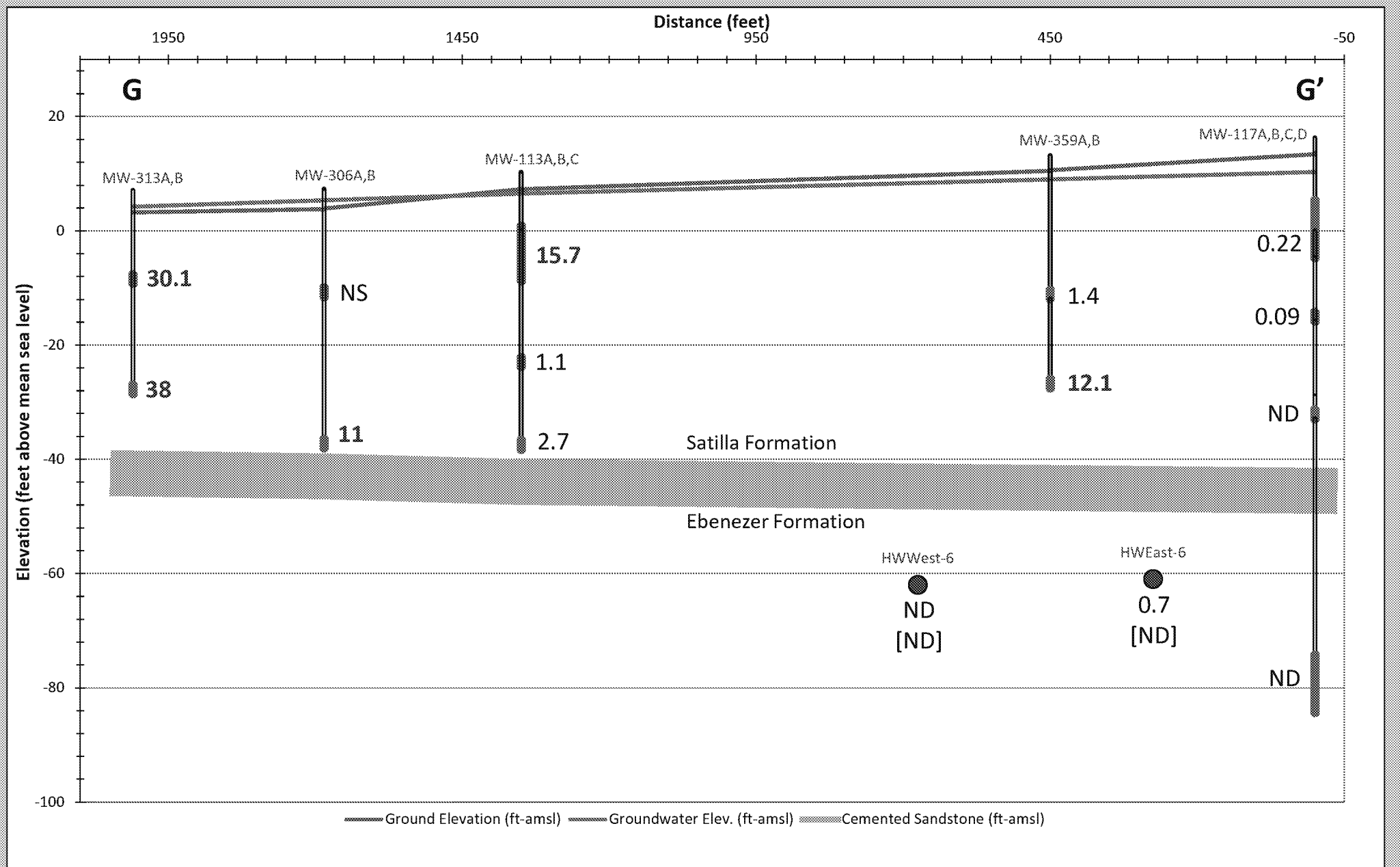
<u>Se</u>
- No issue in 2017

<u>V & Naphthalene</u>
- >MCL/RSL across transect except MW-117 series
- Highest concentration in western most marsh well



Transect G-G'

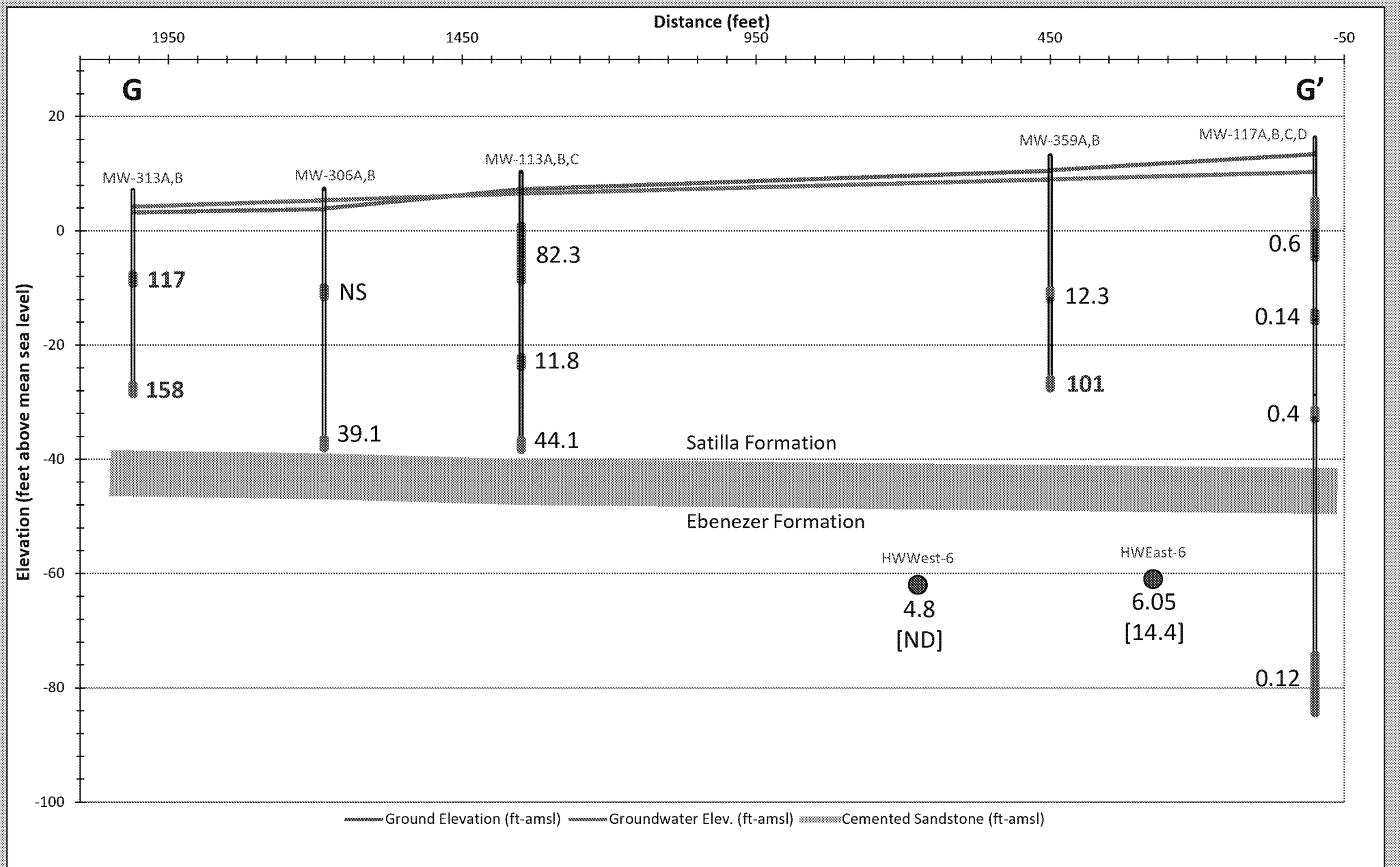
2017 Arsenic MCL: 10 µg/L



[2019 Testing Result]

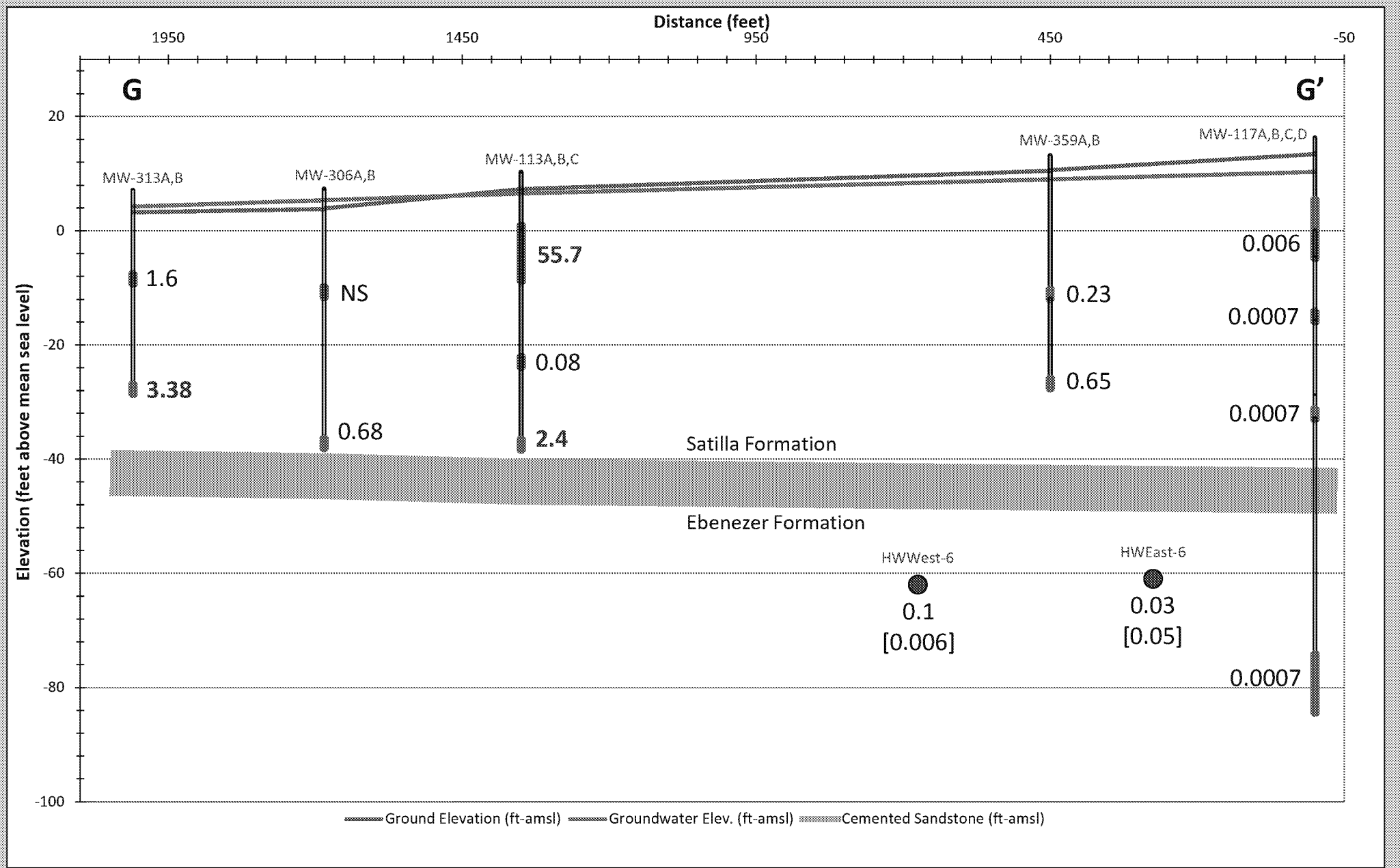
Transect G-G'

2017 Chromium (total) MCL: 100 µg/L



[2019 Testing Result]

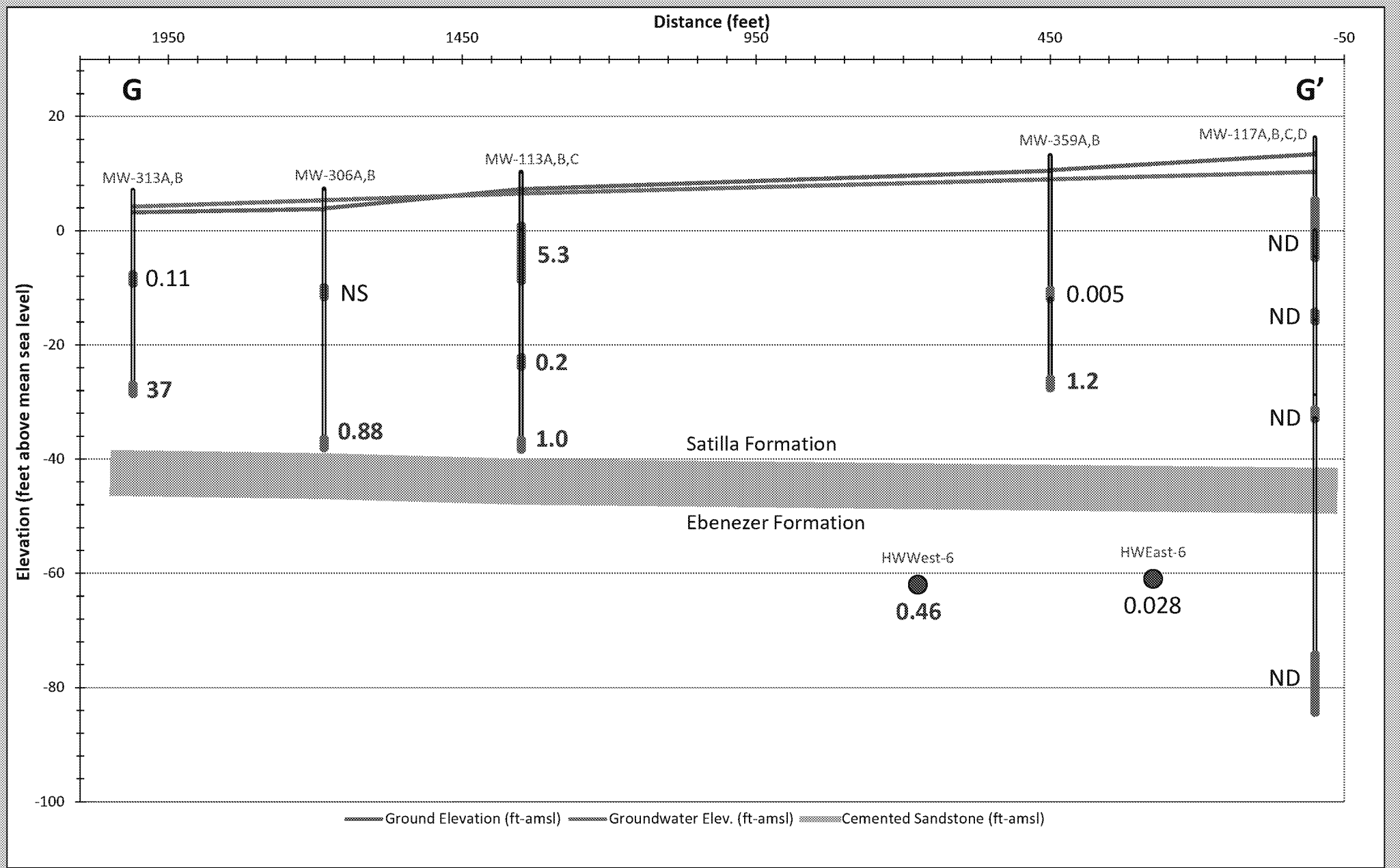
Transect G-G'
2017 Mercury MCL: 2 µg/L



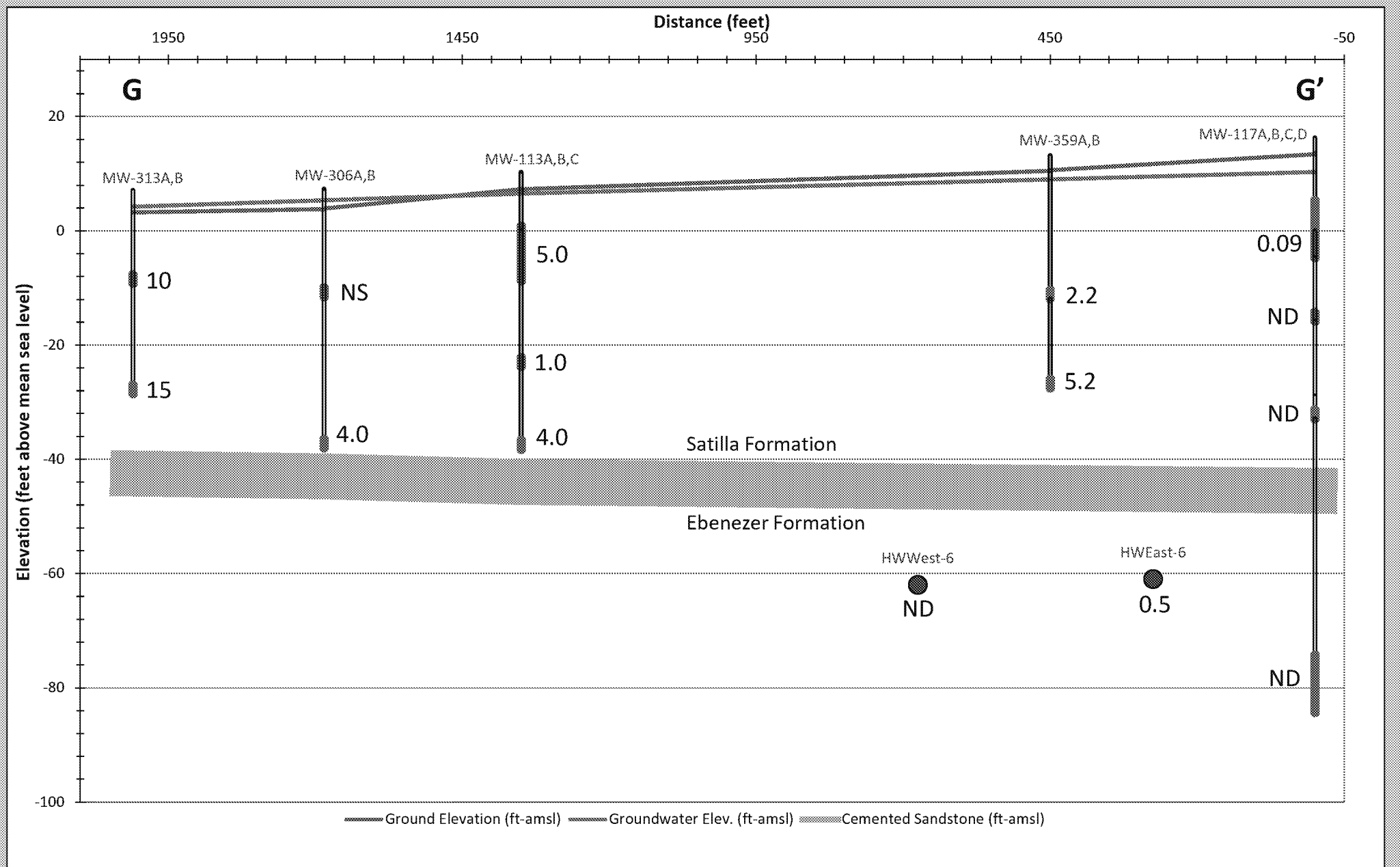
[2019 Testing Result]

Transect G-G’

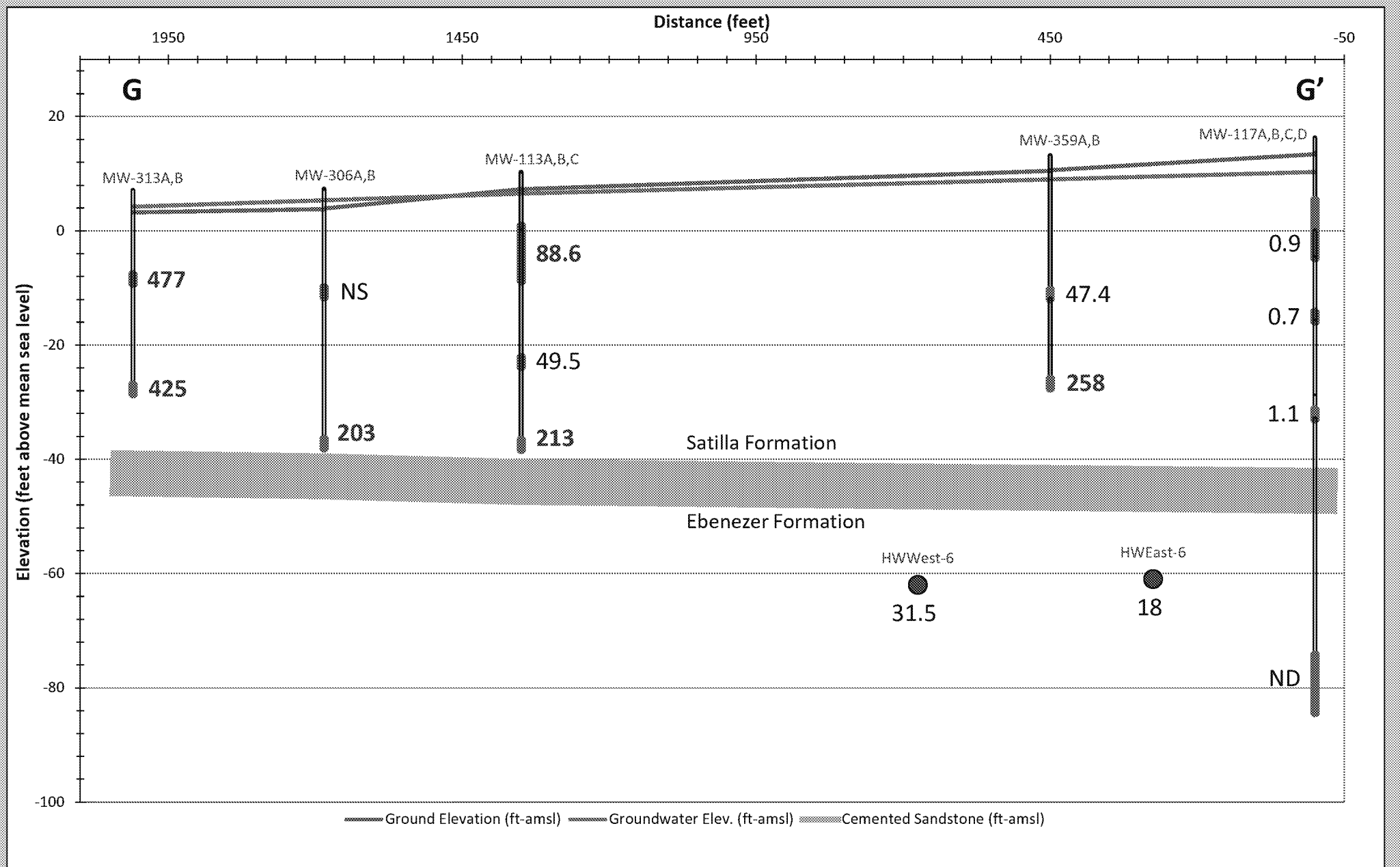
2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



Transect G-G'
2017 Selenium MCL: 50 µg/L



Transect G-G'
2017 Vanadium RSL: 86 µg/L



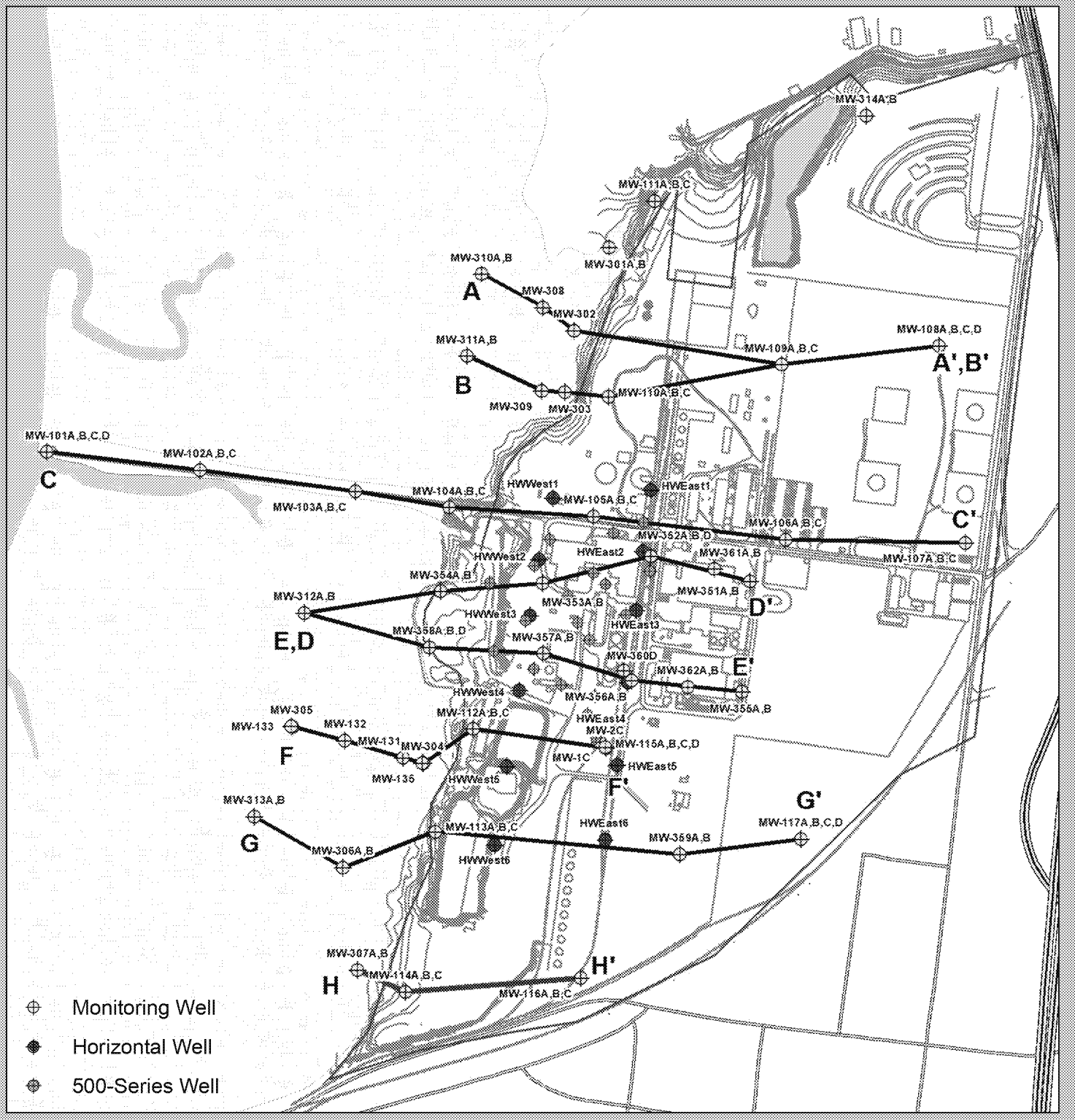
Transect H-H'

MW-116A,B,C
MW-114A,B,C
MW-307A,B

<u>As, Cr, Hg & Se</u>
- No MCL/RSL issues
- Concentrations generally higher is western most well

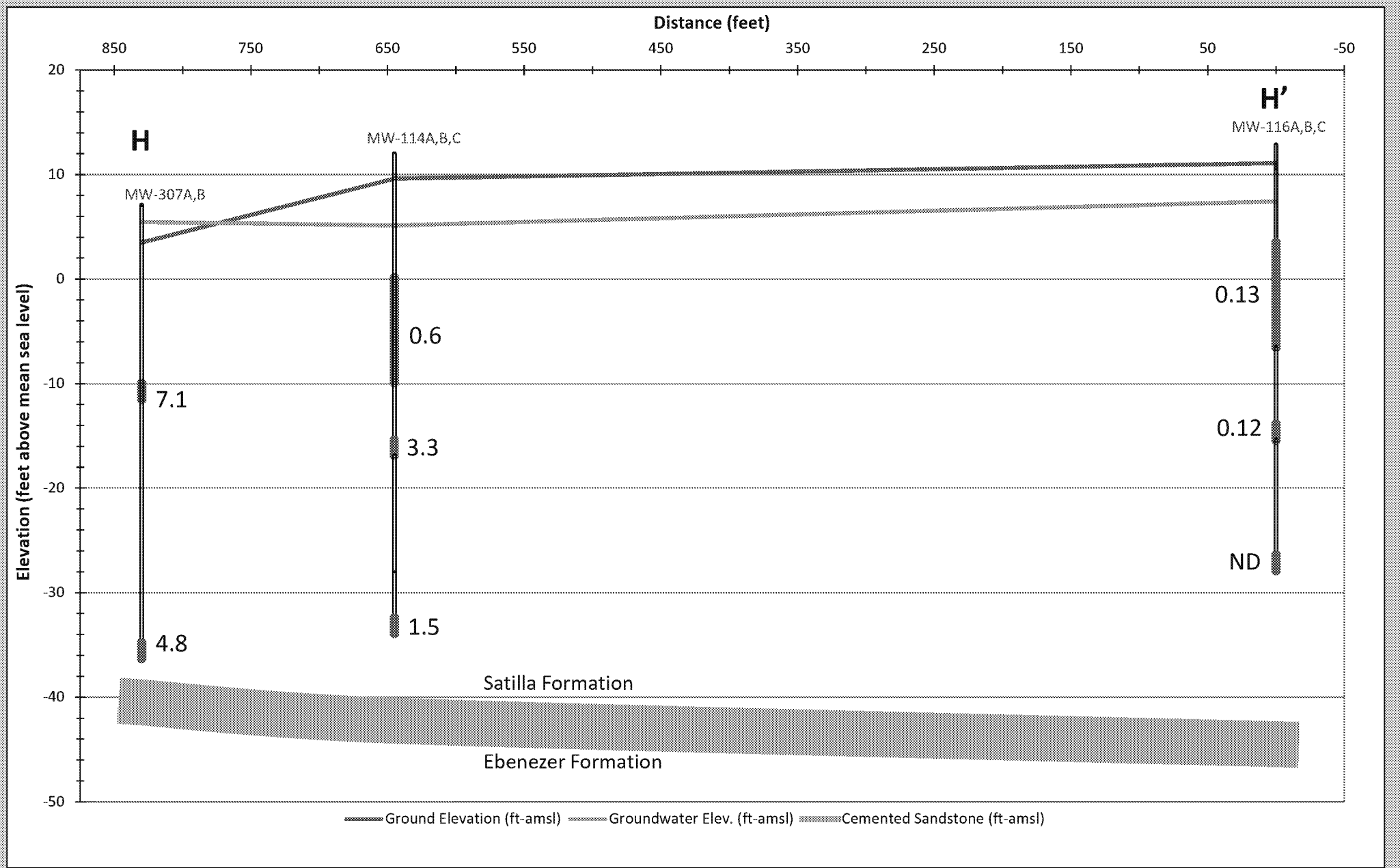
<u>V</u>
- > MCL at marsh border and in marsh

<u>Naphthalene</u>
- > RSL across transect

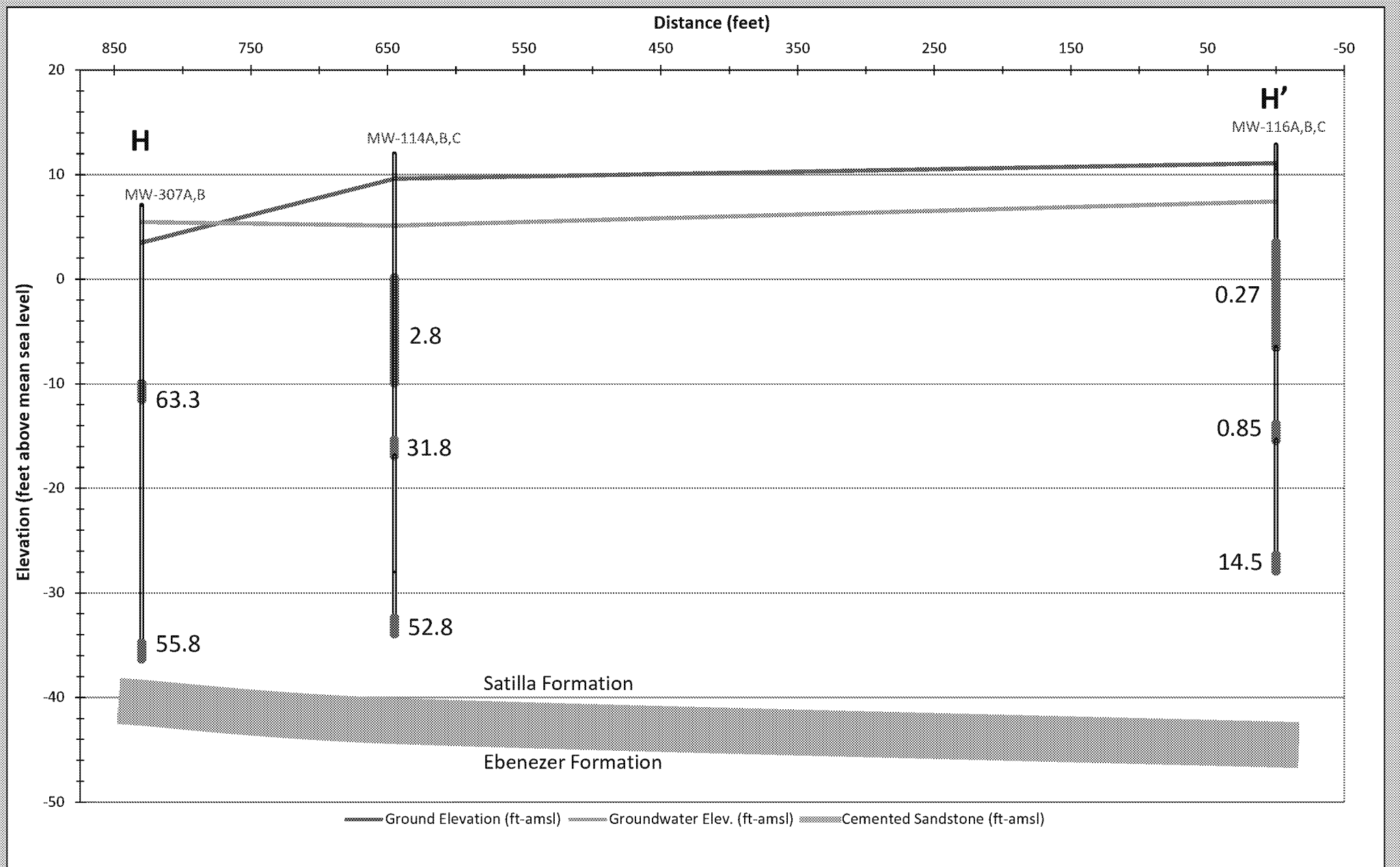


Transect H-H'

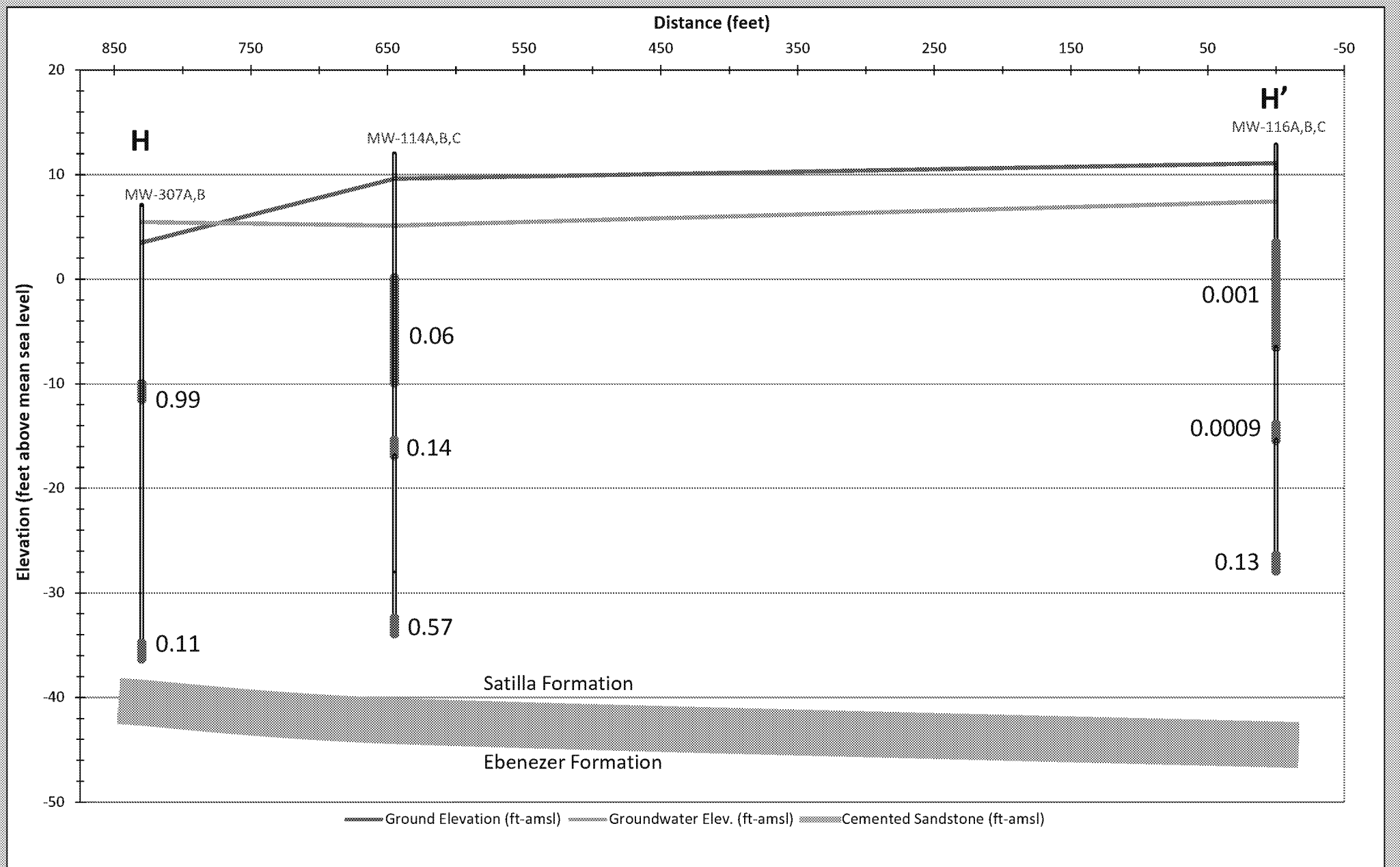
2017 Arsenic MCL: 10 µg/L



Transect H-H’
2017 Chromium (total) MCL: 100 µg/L

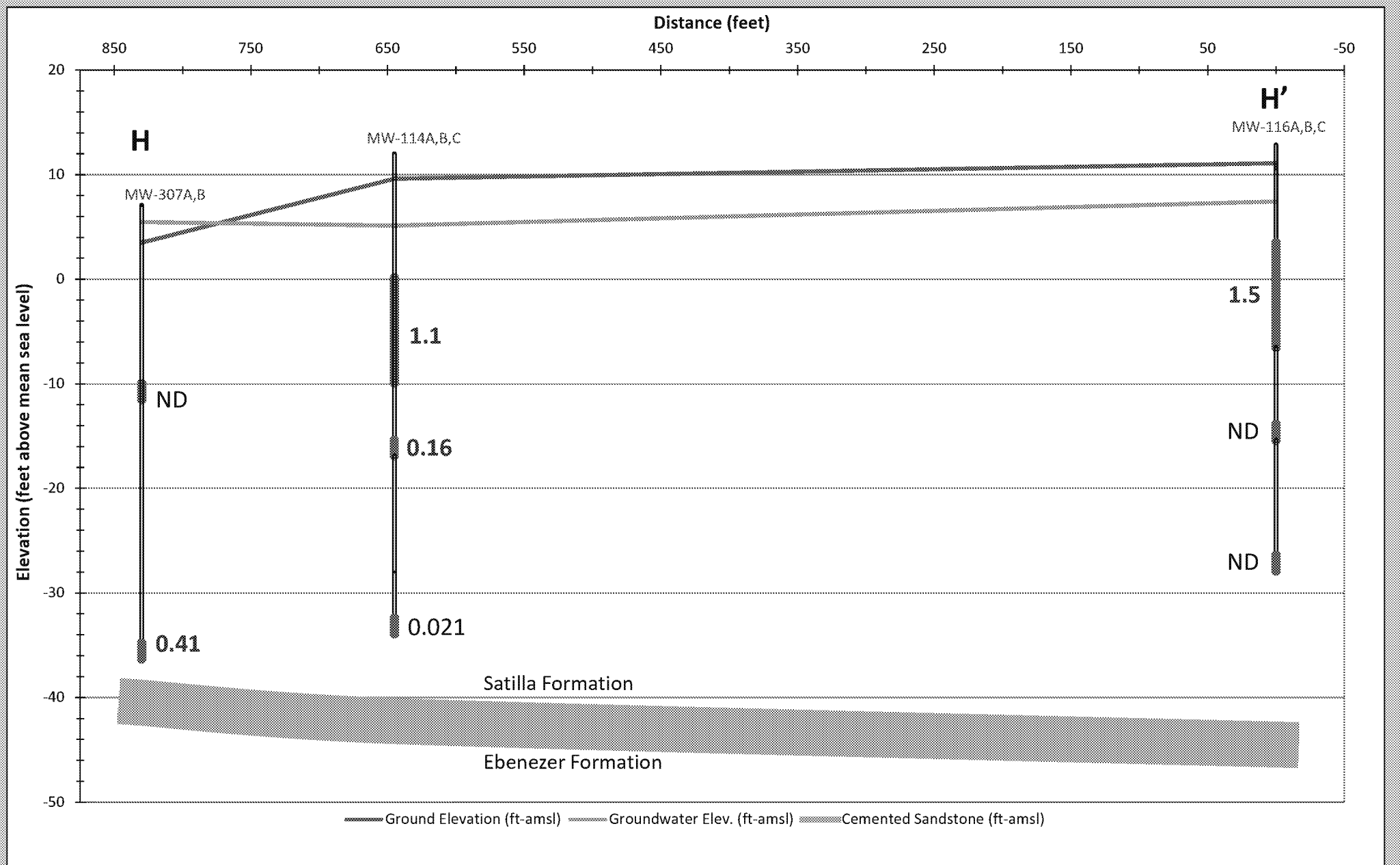


Transect H-H'
2017 Mercury MCL: 2 µg/L

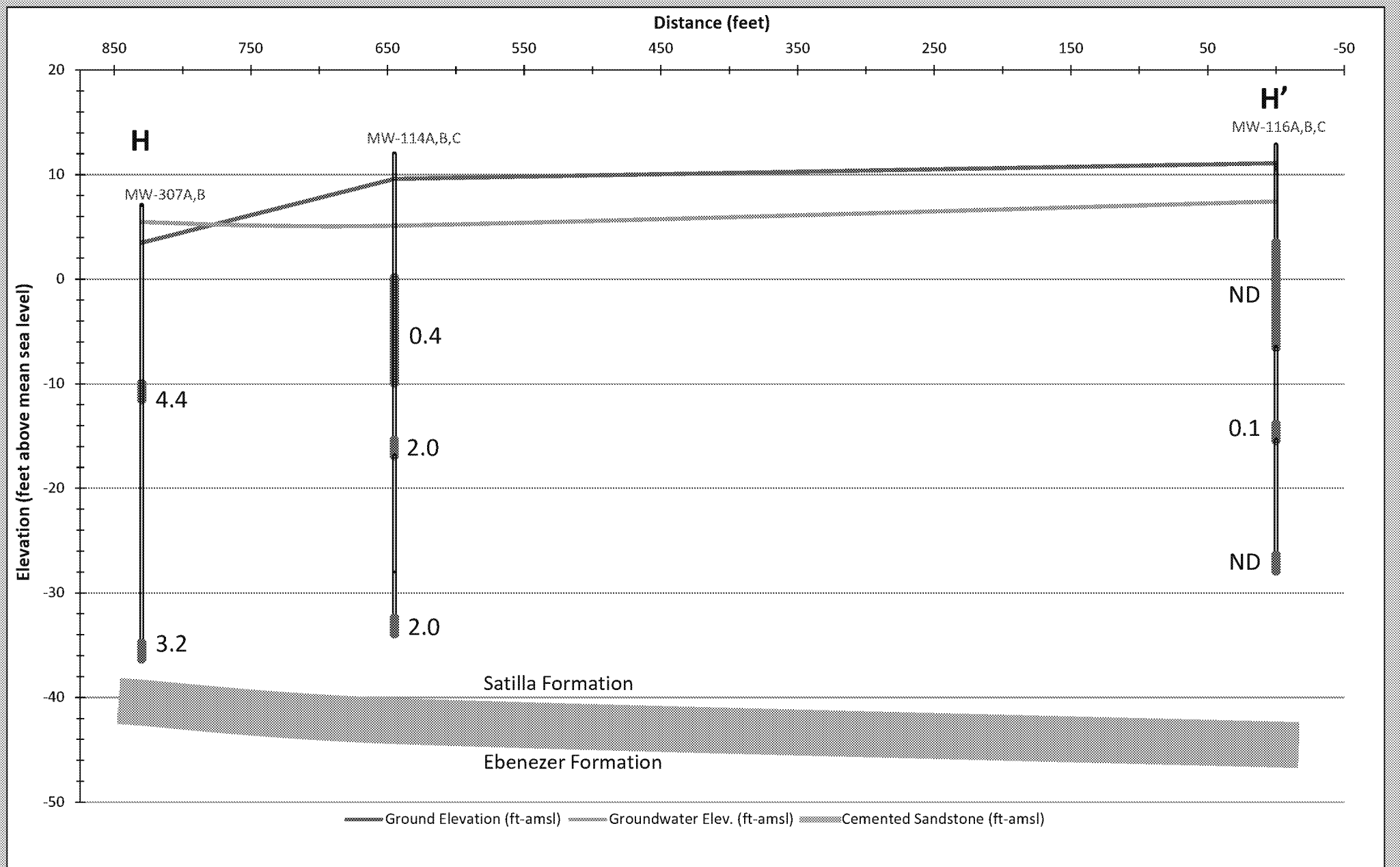


Transect H-H'

2017 Naphthalene RSL: 0.12 µg/L (Lifetime Health Advisory: 100 µg/L)



Transect H-H'
2017 Selenium MCL: 50 µg/L



Transect H-H' **RSL: 86 µg/L**

2017 Vanadium